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June 17, 1960
Vol. 33, No. 6

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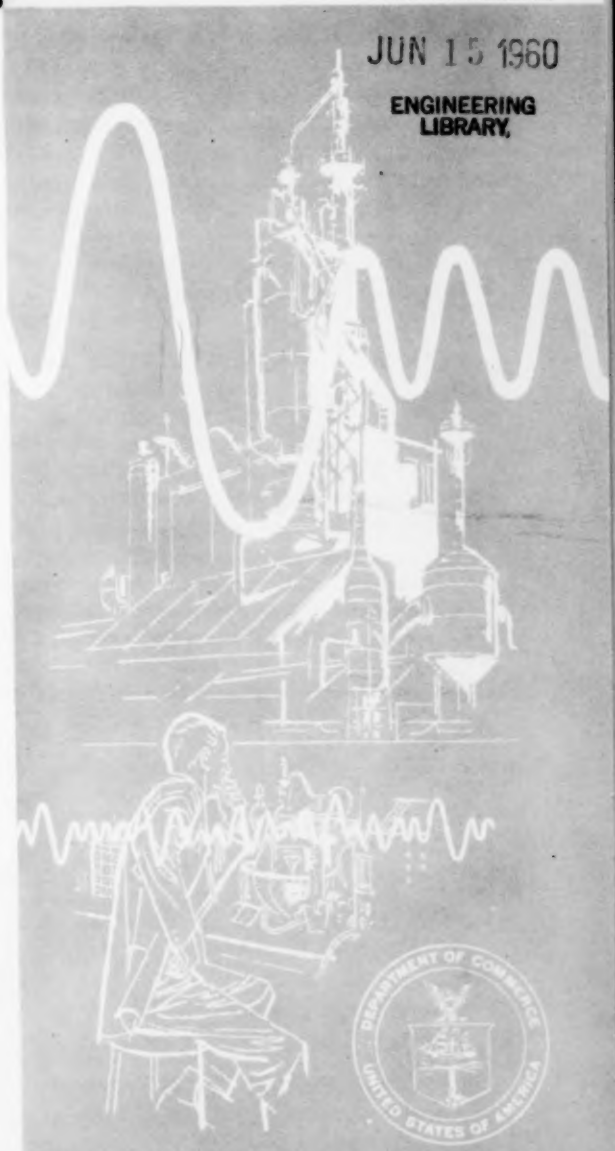

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MATHEMATICS

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Vo. 33, No. 6 Pp. 595-701 June 17, 1960

BIBLIOGRAPHY

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JOURNAL ARTICLES JULY-DECEMBER 1958, comp. by Peter S. Deck. 25 Sep 59, 12p. 29 refs. CWL Special Pub. 4-14.
Order from LC mi$2. 40, ph$3. 30 PB 145 635

This list of articles published in journals during July-December 1958 was compiled from reprint orders and notifications of publication made available by the authors. A file of reprints, covering all but a few articles, is available in the Technical Information Division. In most cases, copies of reprints may be obtained from the authors. The articles are listed chronologically within each Directorate. (Author) (See also PB 138 345)

Electrical Engineering Research Lab., U. of Texas, Austin.
SUMMARY BIBLIOGRAPHY OF TECHNICAL REPORTS, PUBLICATIONS AND THESES. Rept. on Contract Nonr-375(01). 28 Feb 59, 51p. 423 refs. Rept. no. 106.
Order from LC mi$3. 60, ph$9. 30 PB 144 894

This report has been prepared in an effort to consolidate all technical publications of this Laboratory in one volume. To reduce the size of the publication, detailed references have been made only to the technical as contrasted to the status type report and a previously included section on papers presented at technical meetings has been deleted. The section on theses has been retained. The technical publications are listed numerically with title, data, classification (if any), author(s) and contract number serving as identification. They are grouped generally into broad subdivisions of Navy, Air Force and Army support.

ASTRONOMY

Saskatchewan U. (Canada).
INVESTIGATIONS OF THE MEINEL N_2^+ BANDS IN THE AURORA IN THE 1.0 TO 2.0μ REGION, by A. W. Harrison. Scientific rept. no. BR-9 on Contract AF 19(604)1831. Mar 58, 15p. 15 refs. AFCRC-TN-58-293; AD-152 541; AD-230 666.
Order from LC mi$2. 40, ph$3. 30 PB 145 657

Saskatchewan U. (Canada).
A NOMOGRAM FOR SOLVING SPHERICAL TRIANGLES, by D. M. Hunten. Scientific rept. no. BR-8 on Contract AF 19(604)1831. Mar 58, 14p. 2 refs. AFCRC-TN-58-292; AD-152 540; AD-230 667.
Order from LC mi$2. 40, ph$3. 30 PB 145 586

A nomogram is presented which converts between celestial and horizon coordinates for a single latitude. In 8 by 10 inch size the accuracy averages half a degree. It may also be used to find range and bearing of any point on the earth from its latitude and longitude. The construction is easy since it consists of two straight lines and a circle graduated according to simple rules. Examples of use, directions for construction, and theory are included. (Author)

Astrophysics

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
DEDUCTION OF VERTICAL THERMAL STRUCTURE OF A PLANETARY ATMOSPHERE FROM A SATELLITE, by J. I. F. King. Rept. on Contract AF 04(647)269. 11 Dec 59, 17p. 6 refs. Technical Information Series R59SD477.
Order from LC mi$2. 40, ph$3. 30 PB 145 180

An inversion technique is developed for deducing the temperature stratification of a planetary atmosphere from the variation of the emission spectrum with air mass. This is a planetary application of the well-known solar limb-darkening effect. Mathematically, the emergent intensity is an integral transform of the Planckian temperature taken as a function of optical depth. The solution therefore consists in devising a scheme for inverting the transform. Pending satellite observations, the following approach is used for the verification of the theory. Ground observations of the 9. 6 micron ozone band as a function of air mass thickness have been taken. These radiative data provide information on ozone "at a distance", in a manner similar to the remote satellite viewing from above. Four sets of ozone emission data have been analyzed and the vertical thermal structure of the ozonosphere deduced therefrom. A critique of the method together with future research directions is given. (Author)

Dublin Inst. for Advanced Studies [Eire].
[INVESTIGATIONS OF THE RATES OF EXTENSIVE PENETRATING SHOWERS, HIGH ENERGY LOCAL SHOWERS AND DENSE ELECTRONIC SHOWERS OF THE COSMIC RADIATION, by C. B. A. McCusker]. Final technical rept. for 1 Dec 58-30 Nov 59 on Contract AF 61(052)163. 12p. 15 refs. AFOSR-TR-60-12.
Order from LC mi$2. 40, ph$3. 30 PB 145 678

The report covers work on solar time variations in local penetrating and dense extensive cosmic ray showers; on the variation over the sky of primaries causing extensive air showers at sea level; on the structure of extensive air showers; the performance of directional arrays and on pressure variations resulting from atmospheric tides. (Author)

Oslo U. (Norway).
THE DETERMINATION OF POSITION AND POLARIZATION OF SOURCES OF ENHANCED SOLAR RADIATION ON 200 Mc/s, by Per Maltby. [1958] 32p. 15 refs. Scientific rept. no. 10(20) on Contract AF 61(514)1122. AFCRC-TN-58-471; AD-160 747.
Order from LC mi$3.00, ph$6.30 PB 145 656

An interferometer has been built at the Solar Observatory, Harestua, for observing the position of sources of enhanced solar radiation on 200 Mc/s. The interferometer, the method for analysing the observations, and some sources of error are described in Part I. Part II of the present paper deals with the measurement of polarization by means of three antennas, one of which is polarized orthogonally. Several sources of error are discussed. (Author)

Oslo U. (Norway).
RESEARCHES IN THE FIELD OF SOLAR RADIO NOISE, SUNSPOTS, PROMINENCES AND FLARES. Technical (final) rept. on Contract AF 61(514)1122. 21 Jan 59, 39p. 13 refs. AFCRC-TR-59-233; AD-213 622.
Order from LC mi$3.00, ph$6.30 PB 145 650

A summary is presented of the many projects underway. An appendix contains a series of 30 frames of solar images in H_α-light was selected from a film taken at Tromsö during a 28 hour spell of fair observational conditions.

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TACTUAL CODING OF CYLINDRICAL KNOBS, by James V. Bradley. Rept. on Control Design and Arrangement, done partially at Antioch Coll. on Contract AF 33(616)6095. Sep 59, 33p. 18 refs. WADC Technical rept. 59-182.
Order from OTS $1.00 PB 161 483

Tactual coding of knobs by use of bizarre shapes is frequently achieved at the expense of manipulability and setting precision, which appear, in many cases, to be optimal when knobs are cylindrical. In order to be able to maximize both discriminability and manipulability, certain parameters of cylindrical knobs were investigated as bases for tactual coding. Rim surface, diameter and thickness were all found to be useful for this purpose. When feeling one of two knobs whose pictures were before them, subjects rarely (less than 1% of the time) identified the wrong picture as the felt knob in any of the following situations: diameters differ by 1/2 inch or more, thicknesses differ by 3/8 inch or more, rim surfaces belong to different ones of the three families: smooth, fluted, knurled. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
A COMPARISON OF TWO METHODS OF CONTROLLER TRAINING IN SIMULATED AIR TRAFFIC CONTROL TASK. A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL, by J. S. Kidd. Rept. on Contract AF 33(616)3612. Jan 59, 27p. 16 refs. WADC Technical rept. 58-449; AD-212 269.
Order from LC mi$2.70, ph$4.80 PB 146 196

Improvement in performance with training in a complex task of radar air traffic control was compared under a condition of constant high input load during training vs. a condition of graduated input load during training. Relative input load was defined as the number of aircraft under the control of a single pattern-feeder operator. The test performance of controllers trained under constant high input load was significantly superior on several criteria to that of controllers trained under the graduated input load condition. An explanation was proposed in terms of the heightened frequency of feedback of knowledge of performance experienced by the high constant input load group. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
INFORMATION INPUT AND PROCESSING VARIABLES IN MAN MACHINE SYSTEMS: A REVIEW OF THE LITERATURE, by William C. Howell and George E. Briggs. Rept. on Contract N61339-508. 26 Oct 59, 75p. 245 refs. Technical rept. NAVTRADEVCEN-508-1.
Order from LC mi$4.50, ph$12.30 PB 145 160

The results of this survey provide recommendations for the handling of information by the various sensory systems. Specifically, the results point out: (1) The variables relevant to sensory input with regard to their potential as display channels, and the problems involved in detecting and responding to distorted signals. (2) The variables involving the amount of input information and the manner in which it is distributed over time and space. (3) A few highly selected display-control relationships that are worthy of future experimentation and study.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
OPERATOR CHANGE-OVER EFFECTS IN A COMPLEX TASK, by J. S. Kidd and Robert G. Kinkade. Rept. on Contract AF 33(616)3612, continuation of Contract AF 33(616)43. Aug 59. 17p. 14 refs. WADC Technical rept. 59-235.
Order from OTS $0.50 PB 161 529

The two experiments covered in this report were concerned primarily with the loss in system performance due to operator change-over and extended work duration. Using 12 laboratory-trained controllers in a simulated air traffic control task, it was found that (a) a significant but short-duration decrement occurred at operator change-over, (b) performance was highly stable over the 3.5-hr. work period, (c) a prominent "end-spurt" occurred, and (d) the degree of prechange-over participation by the replacement controller could modify the extent of performance loss at change-over. These findings were evaluated with respect to studies of warm-up, preparatory set, and work fatigue effects observed in other task settings. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
SIZE, BLUR, AND CONTRAST AS VARIABLES AFFECTING THE LEGIBILITY OF ALPHA-NUMERIC SYMBOLS ON RADAR-TYPE DISPLAYS, by William C. Howell and Conrad L. Kraft. Rept. on Contract AF 33(616)3612. Sep 59, 43p. 17 refs. WADC Technical rept. 59-536.
Order from OTS $1.25 PB 161 454

The purpose of this study was to determine the functions relating size, blur, and contrast, and their interactions, to legibility of alpha-numeric symbols on a radar-type display. Twelve subjects served under all 64 conditions obtained by combining factorially four levels of each of three variables: size, blur, and contrast. The stimuli, 36 alpha-numeric symbols, were projected on a ground-glass screen one at a time at a rate controlled by the subject's verbal responses. Instructions stressed equally speed and (Behavioral Sciences--Human Engineering, accuracy. Performance indices were information transmitted, speed, and accuracy. Confusion data were also reported for specific conditions. The results indicated that each of the three variables and two of the interactions significantly influenced legibility. Optimum legibility was obtained at 26.80-min. size, high contrast, and low blur. Larger sizes frequently degraded performance. The implications and possible generality of these data are discussed. (Author)

Personnel and Training

Educational Research Corp. [Cambridge, Mass.]
A COMPARISON OF TWO METHODS OF TEACHING TYPEWRITING, by Phillip J. Rulon and W. Douglas Brooks. Rept. on Contract N61339-294. 11 Jan 60, 39p. 13 refs. Technical rept. NAVTRADEVCEN 294-1.
Order from OTS $1.00 PB 161 512

This study was undertaken to compare the existing method of teaching typewriting in the Navy with a method proposed by L. Robins. The Navy method is characterized by the use of lettered keyboards, demonstration by the instructor and emphasis on speed. All home keys are taught together and additional characters are introduced in groups of two or three. Thus, the keys are learned by their spatial relationship to the home keys. The Robins method is based on the principle of reinforced learning. With this method, all keys are covered and each character is taught separately. Accuracy is emphasized and students discover which letter will be typed when a particular key is depressed. Comparisons of the two groups were made in terms of: (1) typing speed in net words per minute; (2) typing speed in gross words per minute and percentage of strokes resulting in errors considered simultaneously; and (3) the number of periods of classroom instruction required to achieve a prescribed typing speed in net words per minute.

Family Relations Center, San Francisco, Calif.
PROGRAM EFFECTIVENESS IN NAVAL RETRAINING, by E. K. Gunderson, S. D. Mock and others. Technical rept. no. 7 on Rehabilitation of Naval Disciplinary Offenders, Contract Nonr-1535(00). 3 Feb 58, 13p. 11 refs. AD-159 623.
Order from LC mi$2.40, ph$3.30 PB 137 805

An attempt was made to assess retraining program effectiveness under 2 different program orientations. The old program consisted of 3 wk of orientation classes which provided information, films, and counseling designed to promote the mental health of the confinees, assist in their adjustment to confinement, and encourage their military development. The new orientation program for all confinees was reduced from 3 to 2 wk. Confinees designated by the courts to return to duty following their confinement were placed in separate groups from those slated for other than honorable separation from the service. It was stated as policy that the classes in the new program would be directed toward increasing knowledge of military skills and heritage only. The 2 programs differed markedly in their effects on the attitudes, institutional behavior, and postinstitutional military adjustment of confinees. The findings strongly support the hypothesis that a correctional institution cannot achieve its objective of successful treatment unless it has an organized program to substitute conventional orientations for the delinquent values of sentenced offenders.

Naval Personnel Research Field Activity, Washington, D. C.
THE DEVELOPMENT AND VALIDATION OF THE ADVANCED TECHNICIANS TEST, by John J. La Gaipa. July 59, 21p. 2 refs. BuPers Technical Bulletin 59-15. AD-227 324.
Order from LC mi$2.70, ph$4.80 PB 145 044

This is a report of the development of an Advanced Technicians Test (ATT) designed to improve the selection into advanced technical training programs, with particular immediate application to selection for Nuclear (NP) training. Two forms of the ATT have been constructed, consisting of four parts, Reading Comprehension (of technical material), Mathematics, Physics and Electricity. The forms have been tried out on students at the Submarine NP school. A high correspondence was found between total scores on the ATT and grades in the school, and the scores on the Mathematics subtest showed an even higher ability to

predict school grades. Use of the Mathematics test of the ATT as a substitute or a supplement to the Basic Test Battery selection standards is recommended as an aid in selection for the Nuclear Power schools. (Author)

Personnel Lab., Wright Air Development Center, Lackland AFB, Tex.
RATER TENDENCIES IN ESTIMATING QUALIFICATIONS REQUIRED BY AIR FORCE TASKS, by Llewellyn Wiley, Hal B. Harber, and Joyce Giorgia. Sep 59, 12p. WADC-TN-59-195; AD-227 634.
Order from LC mi$2.40, ph$3.30 PB 145 135

The purpose of this study is to determine whether personal evaluation habits may influence interrater agreement. Tasks were drawn from 15 Air Force career fields, and a group of ROTC pilot trainees rated these tasks and the specialties that include them. Judgments were made on 5-point scales to determine how much resourcefulness, general vocabulary, tool and instrument knowledge, number skill, physique and stamina, human contact skill, precision, formal training, and on-the-job training time is needed. Correlation of each rater's over-all mean rating in one session with that of the mean for the second session demonstrated consistent tendencies to give high, low, or medium ratings. Similar correlations between mean standard deviations gave evidence of individual tendencies to use or refrain from using the extremes of the rating scale. (Author)

Psychology

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AN EXPLORATORY STUDY OF PROLONGED INTERMITTENT PHOTIC STIMULATION, by Harold S. Alexander and W. Dean Chiles. Rept. on Human Performance in Advanced Systems. Nov 59, 11p. 2 refs. WADC Technical rept. 59-715.
Order from OTS $0.50 PB 161 504

In order to investigate the resistance of the human operator to effects of intense, flashing lights for prolonged periods of time, four subjects were exposed to very bright intermittent photic stimulation at 5, 10, and 15 cycles per second for a period of 2-1/2 hours. None of the subjects suffered any adverse subjective or behavioral effects, although all became somewhat drowsy from time to time, presumably as a result of the boring nature of the situation. After about one hour of stimulation, all four subjects showed definite evidences of electroencephalographic responses to the lights. (Author)

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
SOME ASPECTS OF PROBLEM-SOLVING: I. METHOD AND MATERIALS, by Paul A. Kolers. Rept. on Psychological Research on Human Performance. Jan 60, 20p. 8 refs. WADD Technical rept. 60-2.
Order from OTS $0.50 PB 161 534

A method is described which enables the experimenter to generate problems of known characteristics for study of perceptual problem-solving behavior. The kinds of data which result from the application of this method are illustrated. The characteristics of the method are: it is free of the experimenter's bias in generating problems; the problems are relatively "content-free" in that little special knowledge is required for their solution; the results are readily interpreted in quantitative terms; and the characteristics of the problems can be manipulated systematically along dimensions of similarity, difficulty, and others. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
STUDIES IN RESEARCH METHODOLOGY. II. CONSEQUENCES OF VIOLATING PARAMETRIC ASSUMPTIONS: FACT AND FALLACY, by James V. Bradley. Research conducted at Antioch Coll. on Contract AF 33(616)3404. Sep 59, 37p. 81 refs. WADC Technical rept. 58-574(II).
Order from OTS $1.00 PB 161 452

Methods of investigating the effects of assumption-violation are examined. Particular attention is given to methodological, and other, bias operating in favor of the conclusion that parametric tests are extremely insensitive to violations of their assumptions. Fallacious arguments advanced in support of this non-normality upon the probability levels and power of the critical ratio test is investigated. Results show that under certain perfectly realistic conditions the test is rendered completely powerless by the violation investigated. (Author) (See also PB 161 335)

Fels Group Dynamic Center, U. of Delaware, Newark.
USE OF AUTOCORRELATION AND UNCERTAINTY MEASURES FOR THE ANALYSIS OF DECISION BEHAVIOR, by Alan Lewis and Vera T. Kanareff. Rept. on Research on Human Intellectual Functions, Contract AF 33(616)5845. Aug 59, 39p. 28 refs. WADC Technical rept. 59-434.
Order from OTS $1.00 PB 161 453

A discussion of two methods of analysis of sequential dependencies is discussed in relation to the study of decision behavior. The methods considered are autocorrelation and uncertainty analysis. Each of these approaches is described in terms of computational techniques and specific applications are presented. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
AUGMENTED FEEDBACK AND TRACKING SKILL, by Robert G. Kinkade. Rept. on Contract N61339-508. 26 Oct 59, 33p. 12 refs. Technical rept. NAVTRADEVCEN-508-3.
Order from LC mi$3.00, ph$6.30 PB 145 162

The results of this study are: (1) The optimum relative amount of augmented feedback is a function of the skill of the operator. (2) In a particular training situation it is important that both the amount and schedule of feedback be considered since these two variables show a significant interaction with one another. (3) Abrupt changes in the amount of feedback have a deleterious effect on performance, especially if the number of sensory cues are diminished.

Laboratory of Aviation Psychology, Ohio State U., Research Foundation, Columbus.
THE DIFFERENTIAL EFFECTS OF SPEED AND LOAD STRESS ON TASK PERFORMANCE, by Gabriel Jeantheau. Master's thesis. Rept. on Contract AF 33(616)3612, Continuation of Contract AF 33(616)43. July 59, 18p. 8 refs. WADC Technical rept. 59-7.
Order from OTS $0.50 PB 161 482

This study investigated effects of speed-load stress (input rate and variety) on performance in an information-processing task requiring discrimination of pairs of identical symbols within matrices of three levels of word length and five levels of presentation rate. Error scores and a derived information measure were used to assess performance. Results indicated that increases in both speed and load seriously impair performance. The data fitted to an information specification of the stimulus situation failed to provide a unitary function. Information scores plotted against mean number of paired comparisons per second, however, yielded a single function which described all conditions and accounted for the high interaction component. It was concluded that (a) specification of the stimulus situation alone does not adequately explain performance, and (b) use of information measures in tasks of this type adds little or nothing to such explanations. A more pertinent consideration is the actual operations required in responding to the task situation. (Author)

Laboratory of Aviation Psychology, Ohio State U., Research Foundation, Columbus.
FIDELITY OF SIMULATION: I. TIME SHARING REQUIREMENTS AND CONTROL LOADING AS FACTORS IN TRANSFER OF TRAINING, by George E. Briggs and Earl L. Wiener. Rept. on Contract N61339-508. 26 Oct 59, 14p. 5 refs. Technical rept. NAVTRADEVCEN-508-4.
Order from LC mi$2.40, ph$3.30 PB 145 163

With a high level of time-sharing, subjects trained with minimum force cues achieved less transfer to a situation characterized by optimum force cues than did subjects trained under a low level of time sharing. Time-sharing requirements tend to increase the importance of proprioceptive information or "control feel" in a two-dimensional compensatory tracking task.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
ON THE RELATIVE IMPORTANCE OF TIME SHARING AT CENTRAL AND PERIPHERAL LEVELS, by George E. Briggs and William C. Howell. Rept. on Contract N61339-508. 26 Oct 59, 19p. 14 refs. Technical rept. NAVTRADEVCEN-508-2.
Order from LC mi$2.40, ph$3.30 PB 145 161

Performance on a task demanding either central time sharing alone or central plus peripheral time sharing deteriorates as input frequency increases. Central time sharing determines the performance levels with display separations of less than 30 degrees of visual angle. The permissible amount of separation between the displays is a function of input frequency with the higher frequency the smaller the separation.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus, Ohio.
SYSTEM PERFORMANCE FOLLOWING RADAR FAILURE IN A SIMULATED AIR TRAFFIC CONTROL SITUATION, by William C. Howell, R. Thomas Christy, and Robert G. Kinkade. Rept. on Contract AF 33(616)3612. Sep 59, 21p. 7 refs. WADC Technical rept. 59-573.
Order from OTS $0.75 PB 161 499

The present experiment investigated the ability of controllers to take over and maintain control of aircraft after loss of PPI information in a simulation of an air traffic control system. The variables examined were the level of control flexibility and prebreakdown activity of controllers. Flexibility, or the number of alternatives available to the controller, was defined by the number of fixed flight paths used (3 vs. 17), and prebreakdown activity was defined by the task of monitoring vs. active controlling. A condition requiring control after prebreakdown monitoring was intended to simulate manual takeover after failure of a semiautomatic control system. In general, the results indicated that whereas procedural flexibility is beneficial to performance during normal operations, it becomes less beneficial and even harmful subsequent to PPI breakdown. Whether the controller is monitoring or controlling prior to breakdown appears to have little effect on performance after breakdown. (Author)

Laboratory of Social Relations, Harvard U., Cambridge, Mass.
EMPIRICAL TESTS OF THE FIRO THEORY OF INTERPERSONAL BEHAVIOR, by William C. Schutz. Final rept. on Contract Nonr-1866(06). 1958, 22p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 145 087

This report covers two empirical studies designed to test certain theorems derived from the postulates of the FIRO theory. Both these studies tested the possibilities of predicting sociometric choice through the use of only one personality questionnaire (FIRO-B) and a theory of compatibility, on two widely different task-oriented groups. Since this is a final report, a brief summary of the relevant parts of the FIRO theory is given before the experiments are described.

Minneapolis-Honeywell Regulator Co., Minn.
SURVEY OF HUMAN DYNAMICS DATA AND A SAMPLE APPLICATION, by John W. Senders. Rept. on Contract AF 33(616)5607. Nov 59, 21p. 11 refs. WADC Technical rept. 59-712.
Order from OTS $0.75 PB 161 503

An approach has been made to the application of the results of research on the human transfer function. A form of a quasi-linear human transfer function has been laid out on the basis of previous experimental results. It has been assumed that human reaction time and neuromuscular lag are constant and that the pilot will adopt a gain and compensation through training which will minimize the mean square tracking error of the system of which he is part. Calculations were made of the mean square tracking error for a one-dimensional simulation of a typical aircraft tracking task. The effects of variation of aircraft dynamics on tracking error were examined. (Author)

Research Center for Mental Health, New York U., N. Y.
PERSONOLOGICAL CORRELATES OF REACTIONS TO PERCEPTUAL ISOLATION, by Robert R. Holt and Leo Goldberger. Rept. on Biophysics of Flight, Contract AF 33(616)6103. Nov 59, 52p. 36 refs. WADC Technical rept. 59-735.
Order from OTS $1.50 PB 161 505

This report describes the aspects of personality (independently measured by objective tests and by clinical Q-sort ratings) that were found to correlate with reactions to eight hours of experimental reality-deprivation (perceptual isolation, sensory deprivation). Fourteen male college students were subjected to an experimental deprivation situation similar to that used in the McGill studies, and from their behavior and verbalizations fourteen measures of reaction were derived. Most of these fell into two internally consistent, not significantly correlated patterns: an adaptive and a maladaptive syndrome. The findings reported and discussed were obtained by correlating rank orders on these syndromes and on each of the fourteen reaction-measures with the various measures of personality. It is hoped that these findings may be relevant to the problems of space crew selection. (Author)

BIOLOGICAL SCIENCES

Anatomy and Physiology

Aerospace Medical Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
DEVELOPMENT OF AN OXYGEN PARTIAL PRESSURE TRANSDUCER, by Edmund B. Weis, Jr., Adolf Marko and others. Rept. for Sep 58-Sep 59 on Instrumentation Research. Nov 59, 19p. 9 refs. WADC Technical note 59-395.
Order from OTS $0.50 PB 161 524

This investigation was undertaken to establish a method for monitoring oxygen supply of man during stress experiments. An analysis of various systems for measuring oxygen partial pressure led to the selection of the polarographic principle. The polarographic system of analysis was examined in detail and a modified polarographic cell with a bare cathode and a fast response time was investigated. The bare cathode oxygen sensor has instabilities due to interface variations which will require extensive study to achieve accuracy. Polarographic analysis is useful for blood and atmospheric oxygen tension monitoring. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
INFLUENCE OF PRIOR BODY COOLING WITH AIR ON HUMAN HEAT TOLERANCE, by James H. Veghte and Paul Webb. Rept. on Physiology in Extended Environments. Sep 59, 17p. 6 refs. WADC Technical rept. 59-350.
Order from OTS $0.50 PB 161 485

This study was conducted with three experienced subjects to determine the feasibility of using a ventilating suit as a vehicle for body cooling prior to heat exposures. Various ventilating air temperatures, flows, and time durations were explored. The results confirm the applicability of this approach for prior body cooling and extension of tolerance times to a heat stress. Optimal air temperature for air cooling in terms of subjective comfort appears to be approximately 45°F. for 60 minutes or longer. Maximum airflow rate recommended with the ventilating garment is 25 c.f.m. Heavy insulation should be worn over the ventilating garment while cooling and may be worn throughout the heat or flight situation with no tolerance impairment. (Author)

Allan Memorial Inst. of Psychiatry (Canada).
MANUAL OF SURFACE ELECTROMYOGRAPHY, by John F. Davis. Rept. on Contract DA 49-007-md-70, 1952, reissued by Antioch Coll. on Criteria for the Design and Arrangement of Displays, Contract AF 33(616)6095. Dec 59, 131p. 15 refs. WADC Technical rept. 59-184.
Order from OTS $2.75 PB 161 528

The methodology and instrumentation of surface electromyography are presented in detail. Principles (and applications of principles) of electrode placement are given along with certain standard placements. Various types of ink-writing electromyographs and accessories are evaluated and specifications are outlined for a satisfactory research instrument. These specifications include type of power supply, type of recorder, and desirable characteristics for the pre-amplifiers, the main amplifiers, and the control panel. Basic principles are given for layout and construction of laboratory rooms so as to minimize artifacts in the EMG record. Finally, the manual discusses the operation of EMG instruments, including methods of eliminating various artifacts, and the measurement of both primary and integrated records. Illustrations of electrode placements and construction and schematics of ink-writing electromyographs are provided. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
STUDIES ON THE PARASITES OF EDIBLE ANIMALS OF ALASKA, by T. T. Dunagan. Oct 57, 18p. 1 ref. Technical note AAL-TN-57-14.
Order from LC mi$2.40, ph$3.30 PB 145 372

Considering the number and types of parasites found in all groups of edible animals in the arctic and subarctic, climate apparently has very little adverse influence on parasite distribution or the maintenance of their life cycles.

Army Chemical Warfare Labs., Army Chemical Center, Md.
RECIPROCAL POTENTIATING ACTION OF DEPOLARIZING SUBSTANCES ON THE ISOLATED FROG RECTUS ABDOMINIS MUSCLE, by Joseph H. Fleisher, Joseph P. Corrigan, and John W. Howard. Sep 59, 16p. 14 refs. CWLR-2315; AD-228 454.
Order from LC mi$2.40, ph$3.30 PB 145 140

The action of the organophosphorus compounds, diisopropyl phosphorofluoridate (DFP) and isopropyl methylphosphonofluoridate (GB), at neuromuscular junctions, has been attributed in part to a direct enhancement of the response to acetylcholine over and above that due to the anticholinesterase properties of these compounds. Subthreshold concentrations of the depolarizing agents, acetylcholine (ACh) and decamethonium (C-10), were found to potentiate the contracture of the myoneural junction of the isolated frog rectus abdominis muscle elicited by effective doses of the same drugs and choline in the absence of GB. Comparable potentiation of the contracture produced by C-10 or choline could be obtained by alternate stimulation with ACh in the absence of DFP or GB. Furthermore, DEP alone did not effect potentiation in the absence of alternate stimulation with ACh. Finally, the inhibitory action of d-tubocurarine on receptor sites of the frog rectus muscle was not antagonized by GB over and above the anticurare activity derived from its anticholinesterase action. It is concluded that the enhancement of the response of the frog rectus abdominis muscle to ACh produced by DEP and GB is brought about exclusively by their action as cholinesterase inhibitors. The apparent capacity of DFP or GB to potentiate contractures elicited by C-10 and choline may be attributed to a facilitation of the action of the depolarizing compounds by subthreshold concentrations of ACH available in the presence of these anticholinesterases. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
BEHAVIORAL AND PHYSIOLOGICAL EFFECTS OF EXPOSURE TO A SIMULATED JUNO II ACCELERATION PATTERN, by Robert M. Herrick, George H. Kydd, and Richard L. Fenichel. 21 Sep 59, 14p. 4 refs. NADC-MA-5913; Bu Med. Proj. MR 005.15-0002.16, R-1; Bu Aer Proj. TED ADC AE 1412.2.
Order from LC mi$2.40, ph$3.30 PB 145 133

The purpose of the present experiment was to determine how exposure to a simulated accleration pattern of the Juno II missile system affected the subsequent behavior of rats. The findings of the experiment indicate that, within the limits of the simulation, exposure to the acceleration pattern will not detrimentally affect rats either physiologically or behaviorally. This means that in an analysis of the results of a biosatellite study designed to evaluate the influence of zero G upon behavior the fact that the rats were exposed to the Juno II acceleration pattern may be ignored. (Author)

George Washington U., Washington, D. C.
AN IMMUNOLOGICAL INVESTIGATION OF THE HERPES SIMPLEX VIRUS. A STUDY OF THE INTERFERENCE PHENOMENON WITH THE HERPES SIMPLEX VIRUS, by Mary Louise Robbins. Final rept. for 1 June 51-30 Sep 55 on Contract Nonr-291(00). [1955] 5p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 137 504

The purpose of this project was to perfect a complement fixation test for the diagnosis of herpes simplex infection, to investigate the antigenic structure of the herpes simplex virus, and to study the interference phenomenon with the herpes simplex virus as an aid to demonstration of strain differences.

Lamont Geological Observatory, Palisades, N. Y.
AN OPEN CONSTANT TEMPERATURE BOX, by Carolyn Beckman. Technical rept. no. 1 on Effect of Temperature on the Population Growth of Marine Organisms, Contract Nonr-266(41). Jan 58, 11p. CU-2-58 Nonr 266(41) Geol.; AD-152 328.
Order from LC mi$2.40, ph$3.30 PB 138 284

Seven open constant-temperature boxes were fabricated for use in the study of the effect of temperature on the population growth of marine woodborers. The outer box comprised 11 1/4-by 12-in. ends, 12-by 23-in. sides, and an 11 1/4-by 22 1/4-in. bottom and was constructed of 3/8-in. plywood and lined with Al foil. The inner box was constructed of 1/4-in. plywood and comprised 6 1/2-by 8 1/2-in. ends, 8 1/2-by 16 1/2-in. sides, a 6-by 16-in. bottom, tapered 6 1/2-by 11 1/4-in. top ends, and tapered 16-by 22 1/2-in. top sides; 3/16-in. holes were drilled 1 cm apart in the walls to aid in the distribution of the heat from the space between the walls. The wiring consists of an electric cord, 15 ft of asbestos insulated B and S, 26-gage, Chromel A, heating wire and a Fenwal thermostat 17300-0. Transite brackets hold the wire near the surface of the inner box. Glass-fiber building insulation fills the space between the walls of the boxes. Of the 2 boxes tested, box 1 was kept in a refrigerator which varied 4°C. Air temperature variation within the box under these conditions was about 0.6°C at a refrigerator temperature of 0°C. Box 2, exposed to room temperature which varied about 8°C, varied 1.2°C.

Miami Valley Hospital, Dayton, Ohio.
I^{131}-LABELED DIIODO-AMINOHIPPURIC ACID AS A TRACER IN CARDIAC OUTPUT STUDIES, by George M. Homer, Robert E. Zipf and others. Rept. for 31 July 58-31 July 59 on Physiology of Flight, Contract AF 33(616)3588. Dec 59, 48p. 11 refs. WADC Technical rept. 59-126.
Order from OTS $1.25 PB 161 527

Radioiodinated diiodo-p-aminohippuric acid ($DI^{131}PAH$) has been synthesized as the sodium salt and examined for its potential usefulness in measuring the cardiac output in animals. This labeled compound has been injected intravenously into rats, rabbits, and eleven dogs for study. Following the administration of $DI^{131}PAH$ to dogs, the rapid removal from the blood stream has been calculated as 50% and 90% in 1.8 and 9.3 minutes, respectively. Forty percent of the injected radioactivity was collected in the urine over an average experimental period of 3 hours. On autopsy of injected and sacrificed dogs, only a very low level of radioactivity was found to have localized in the tissues. Although the gall bladder was found to concentrate the injected compound or a metabolite thereof in the bile, this organ was readily emptied of its contents by means of olive oil administration to the animal previous to and following the injection of $DI^{131}PAH$. Cardiac output values determined with $DI^{131}PAH$ on dogs were reproducible and in the range of reported values determined with other materials. The advantage of $DI^{131}PAH$ over other labeled materials for the measurement of cardiac output is discussed. (Author)

Rochester U., N. Y.
LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE, by Robert M. Boynton, Charles Elworth, and Richard M. Palmer. Rept. on Improving Visual Efficiency of Flying, Contract AF 33(616)2565. Apr 58, 67p. 14 refs. WADC Technical rept. 55-304, Pt. 3; AD-142 274.
Order from LC mi$3.90, ph$10.80 PB 146 138

A mathematical relationship is worked out which yields the contrast required for 60% correct recognition as a function of subject-target distance, exposure time, and number of confusion forms (struniforms) among which the critical target may be located. By translating altitude into experimental distance, aircraft velocity into viewing time, and conditions of viewing (including meteorological conditions) into contrast, predictions are made about how performance should vary as a function of altitude, from 500 to 30,000 ft. General statements are given which attempt to summarize the results of these calculations. (See also PB 146 139)

Rochester U., N. Y.
LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE by Robert M. Boynton and William R. Bush. Rept. on Improving Visual Efficiency of Flying, Contract AF 33(616)2565. Apr 57, 54p. 4 refs. WADC Technical rept. 55-304, pt. 2; AD-118 250.
Order from LC mi$3.60, ph$9.30 PB 146 139

This is the second part of a three-stage program concerning the investigation of relevant variables involved in visual air reconnaissance. Using the apparatus and procedures developed during the first stage, experimentation has been conducted to determine the effects of (a) brightness contrast, (b) an extended range of distances, (c) response tendencies of the subjects, (d) numbers of figures in an array, (e) exposure time, and (f) experience with an array, on the ability of human subjects to detect and correctly identify a rectilinear form among a group of curvilinear forms. Results are presented as percent correct recognition (i.e., correctly identifying a "target"), although some data for detection and error responses are also given. Recognition is found to increase with (a) increased contrast, (b) decreased distances, (c) decreased numbers of figures, and (d) increased exposure time, but does not significantly change with either (a) response tendencies, or (b) experience within arrays. Both detection and errors are affected by response tendencies. Conclusions from this research and some consideration of further experimentation are presented in the text. (Author) (See also PB 146 140)

Rochester U., N. Y.
LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE, by Robert M. Boynton and William R. Bush. Rept. on Improving Visual Efficiency of Flying, Contract AF 33(616)2565. Sep 55, 47p. 5 refs. WADC Technical rept. 55-304, Pt. 1; AD-91 874.
Order from LC mi$3.30, ph$7.80 PB 146 140

An apparatus has been constructed whereby three observers can view a complex array of forms under varying conditions of distance, exposure time, number of forms, and brightness contrast. An empirical investigation is reported of the recognizability of various-shaped figures as a function of brightness contrast and distance. Forty-six figures, both rectilinear and curvilinear, have been selected as a result of this study, for use in investigating the variables involved in "seeking out" critical targets in a heterogeneous array. Rectilinear figures, placed among an array of curvilinear figures, have been presented to subjects and the per cent correct responses tabulated. The probability of correct response increases linearly with exposure time (up to approximately 12 sec), decreases linearly with log number of curvilinear forms, and decreases linearly with subject-figure distance. The effects of figure-density, figure-cluster, and learning are also evaluated. (Author)

School of Aviation Medicine [Brooks AFB, Tex.]
THE MULTIPLE FACTOR THEORY OF RESPIRATORY REGULATION. II. UNCOMPENSATED METABOLIC DISTURBANCES OF ACID-BASE BALANCE, by John S. Gray. 14 Dec 45, 19p. 15 refs. Proj. no. 386, rept. no. 2; AD-121 894.
Order from LC mi$2.40, ph$3.30 PB 145 524

On the basis of well-known physico-chemical properties of blood, it has been calculated that the addition of fixed acid to blood in vitro under conditions where gas exchange is prevented should produce extensive increase in H ion concentration and CO_2 tension with little change in bicarbonate content. Analysis of available experimental data reveals that changes resembling the above type occur in vivo in conditions of metabolic acidosis in which respiratory compensation is delayed or prevented. Similar calculations reveal that the addition of $NaHCO_3$ to blood should produce marked increases in CO_2 tension with only mild decreases in H ion concentration. Changes of the above type should occur transiently in vivo following the intravenous injection of $NaHCO_3$, and according to the multiple factor theory should result in a transient hyperpnea followed by a slight depression of respiration. According to the literature these are

the respiratory responses observed to occur experimentally. The multiple factor theory, therefore, provides a simple explanation for this phenomenon without assuming that cellular and arterial pH's change in opposite directions on injecting $NaHCO_3$. (Author)

School of Aviation Medicine, Brooks AFB, Tex.
PHYSIOLOGIC RESPONSE TO WEIGHTLESSNESS; INITIATION OF MICTURITION, by Julian E. Ward, Willard R. Hawkins, and Herbert D. Stallings. Aug 59 6p. 3 refs. Rept. no. 59-35.
Order from LC mi$1.80, ph$1.80 PB 145 099

The capability of subjects to initiate micturition during weightlessness following a period of hydration was studied. One subject was unable to void in the zero-gravity state but was able to in straight and level flight. Four subjects were unsuccessful in either situation. A majority (58 percent) of the subjects noted a slight to marked decrease in urinary urgency when exposed to weightlessness. This may have been due to psychologic factors such as anxiety, apprehension, or diversion of attention induced by a new and exciting environment which completely nullified the vesical contractions. However, there should be another explanation since the majority of these subjects were experienced in jet flying. The consideration is offered that the floor of the urinary bladder may be the primary sensory zone for the sensation of bladder fullness. Scheduling of body waste elimination should be incorporated into the crewman's standard operating procedures and check list.

Pharmacology and Toxicology

[Army] Chemical Corps, Fort Detrick, Md.
SHELLFISH POISONS. I. THE ISOLATION, PURIFICATION AND CHARACTERIZATION OF CLAM AND MUSSEL POISONS, by Edward J. Schantz, James D. Mold and others. Feb 56, 89p. 64 refs. Special rept. 250.
Order from LC mi$4.80, ph$13.80 PB 145 218

The objective of the work was to isolate the highly toxic shellfish poisons in pure form, determine their chemical structure, and use this information as a starting point for the synthesis and development of new CW or BW agents. Volume (I) covers the background and history of the project and details on the purification procedure, evidence for purity, and chemical and physical properties.

[Army] Chemical Corps, Fort Detrick, Md.
SHELLFISH POISONS. II. STUDIES ON THE CHEMICAL STRUCTURE OF CLAM AND MUSSEL POISONS, by James D. Mold, William L. Howard and others. Apr 56, 229p. 140 refs. Special rept. 250.
Order from LC mi$9.90, ph$34.80 PB 145 219

Volume II, contains detailed data on preparation of functional group derivatives of the poison, oxidation of the poison with periodate, permanganate, hydrogen peroxide, and several other oxidizing agents; oxidation in dilute aqueous alkali and at high pH; and acid hydrolysis of the poison. The concluding sections cover preparation of model compounds for use in the determination of the poison structure and an evaluation of degradative studies on the poison in terms of probable structure. (See also PB 145 218)

[Army Chemical Warfare] Labs., Army Chemical Center, Md.
THE ACUTE INHALATION TOXICITY OF THE THERMAL DECOMPOSITION PRODUCTS OF SEVERAL SYNTHETIC LUBRICATING OILS, by Leo Feinsilver, John L. Ferrari and others. Apr 55, 18p. 10 refs. Medical Labs. Research Rept. no. 357.
Order from LC mi$2.40, ph$3.30 PB 146 202

Rats, cats, and dogs were exposed for 4 hours to the fogs resulting from momentarily heating sprays of several synthetic lubricating oils to temperatures of 400° and 700°F. The following oils were tested: bis(2-ethylhexyl) sebacate, a formulated bis(2-ethylhexyl) sebacate, bis(2-ethylhexyl) azelate, bis(2-ethyl hexyl) adipate, di-isoamyl adipate, and dipropylene glycol dipelargonate. Every oil pyrolyzed at 700° F. except di-isoamyl adipate which was nontoxic, produced eye and respiratory irritation in all species; the mortality increased with increasing rate of dispersion of the oil. On the other hand, oils pyrolyzed at 400° F. produced a low incidence of mortality and few pathological changes or toxic signs. Quantitative determination of the following components of the pyrolyzed oil fog were made: carbon monoxide, total aldehydes, and total esters. The toxicity of the pyrolysis products appeared to depend upon the concentration of aldehydes and not on the other two components. (Author)

Colorado U. School of Medicine, Denver.
SEMI-ANNUAL PROGRESS REPORT, by Joseph H. Holmes, Maurice Gaon, and Kurt von Kaulla. Rept. for Oct 58-Mar 59 on Contract DA 18-108-405-cml-264. [1959] 32p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 145 525

Radiobiology

Aerospace Medical Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
MODIFICATION OF TECHNIQUES FOR DETERMINING THE UPTAKE OF IRON-59 IN NEWLY FORMED RED BLOOD CELLS, by Rodney L. Preston and Arthur P. Raun. Rept. on Physiology of Flight. Dec 59, 10p. 4 refs. WADC Technical note 59-214.
Order from OTS $0.50 PB 161 523

Data are presented on the validity of a simplified technique for measuring the incorporation of radioactive iron-59 into newly formed red blood cells in the rat following intraperitoneal administration of the isotope. The method, as described herein, should prove useful in measuring this physiological process under experimental conditions where erythropoiesis may be disturbed. (Author)

Western Biological Labs., Culver City, Calif.
CHRONIC EFFECTS OF LOW LEVEL RADIATION UPON PROTEIN AND AMINO ACID REQUIREMENTS, by B. H. Ershoff, A. F. Wells and others. Rept. for 1 Aug 58-31 May 59 on Health Hazards of Materials and Radiation, Contract AF 33(616)5873. Dec 59, 54p. 4 refs. WADC Technical rept. 59-609.
Order from OTS $1.50 PB 161 501

Immature male rats were fed highly purified diets containing 10, 15, 25, or 45% protein in the form of a cystine-supplemented casein and were continuously exposed for periods as long as 20 weeks to gamma radiation from a cesium-137 source at levels of 0.3, 3, 30, or 300 r per week. Control groups were fed the same diets but were not irradiated. The effects of radiation were neither diminished nor accentuated by alterations in the protein content of the diet. Substituting other proteins or mixtures of amino acids isonitrogenously for cystine-supplemented casein was also without significant effect on radiation response. Oral administration of AET in the diet or by forced feeding just prior to exposure did not afford protection against a single acute dose of x-irradiation in the rat. Incorporating AET in the diet was also ineffective in protecting rats continuously administered gamma radiation for 8 weeks at a level of 300 r per week. Rats continuously exposed to gamma radiation exhibited an impaired discrimination learning performance and depressed general activity at levels well below the minimum dose, required for detectable chemical or morphologic effects. (Author)

CHEMISTRY

Analytical Chemistry

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
X-RAY POWDER PATTERNS AND INDEX; METAL COMPOUNDS WITH N-BENZOYL-N-PHENYLHYDROXYLAMINE, by Frank L. Chan and Ross W. Moshier. Rept. on Experimental Techniques for Materials Research. Sep 59, 31p. 11 refs. WADC Technical rept. 59-533.
Order from OTS $1.00 PB 161 496

Studies on the organic reagent N-benzoyl-N-phenylhydroxylamine have resulted in the preparation of twenty-eight metallic products with this compound. The method of preparation of each compound, its ultimate analysis, formula, melting point, and characteristic color are given. The X-ray diffraction powder patterns and indexes are tabulated for ready reference and identification. The reagent and fifteen compounds are reported. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PRODUCTION CONTROL METHOD FOR DETERMINING THE CHARCOAL LOADING OF WET-PROCESS GAS-AEROSOL MATERIAL CORE LAYERS (E18), by Henry Greenhouse. Sep 59, 9p. CWLR-2312.
Order from LC mi$1.80, ph$1.80 PB 145 633

A production control method has been devised for determining the charcoal loading of E18 core material which is composed of vinyon, viscose, glass fibers, and charcoal. The method is based on two assumptions: first, that the percentages by weight of viscose and vinyon in the sheet are equal; secondly, that the percentage by weight of glass in the sheet is equal to that originally placed in the furnish. An acetone extraction of a sample will give the percentage of vinyon. The percentage of viscose will then be known and using the percentage of glass placed in the furnish the charcoal percentage may be calculated. A number of trial extractions indicate that this method can be applied with an accuracy of about 2%. (Author)

Inorganic Chemistry

James Forrestal Research Center, Princeton, N. J.
IONIC DISORDER IN MANGANOUS OXIDE, by C. Ernest Birchenall. Rept. on Contract AF 49(638)533. Dec 59, 8p. 4 refs. Metallurgy rept. no. 21; AFOSR-TR-60-62; AD-232 393.
Order from LC mi$1.80, ph$1.80 PB 145 668

The dissociation pressure curve of nonstoichiometric manganous oxide determined by Davies and Richardson (Trans. Farad. Soc. 55:604, 1959) was studied. An alternative interpretation is presented which is also based on appreciable intrinsic disorder interacting with the disorder resulting from the deviations from stoichiometric composition. The proposal is made that the dissociation pressure curve can be calculated reasonably well over the whole composition range studied without activity corrections by choosing appropriate equilibrium constant for the reactions $Mn^{2+} \; Mn_i^{2+} + Mn_V''$ and $2\,Mn^{2+} + 1/2\,O_2\,(g) \rightleftharpoons O^{=} + Mn_V'' + 2Mn^{3}$.

Uppsala U. (Sweden).
ADDITION COMPOUNDS OF PHOSPHINE OXIDES, by Ingvar Lindqvist and Gerd Olofsson. Technical note no. 4 on Contract AF 61(052)43. 17 July 59, 12p. 17 refs. AFOSR-TN-59-574; AD-217 021.
Order from LC mi$2.40, ph$3.30 PB 145 620

The formation of addition compounds with phosphine oxides as donor molecules has been studied. New compounds have been prepared. The weak interaction between $HgCl_2$ and $PO(C_6H_5)_3$ has been revealed by a study of the infrared spectra of the compounds $HgCl_2 \cdot PO(C_6H_5)_3$ and $HgCl_2 \cdot PO(C_6H_5)_3$.

Johns Hopkins U., Baltimore, Md.
THE SPECTRA OF RARE EARTH IONS, by G. H. Dieke. Annual rept. no. 1 on Contract AF 49(638)535. 31 Dec 59, 27p. AFOSR-TN-60-43.
Order from LC mi$2.70, ph$4.80 PB 145 687

The following report deals with the free ion spectra of the rare earths. This report also summarizes the work for the whole year and gives in addition enough background material to show the motivation for the work. It is an informal interim report and contains no references.

Organic Chemistry

British Cotton Industry Research Association.
POLYMERS RELATED TO CELLULOSE. Final technical rept. no. 2, 15 Oct 58-14 Oct 59, on Contract DA 91-591-EUC-965. Oct 59, 35p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 240

In extending the study of the reactions between oxycelluloses and amino-compounds special consideration has been given to urea. All the urea-treated products show a greater stability to laundering than the parent oxycelluloses. The mechanism of the reaction between oxycelluloses and urea is discussed. Further reactions of periodate oxidized methyl 4:6-O-benzylidene-α-D-glucoside (OMBG) have been investigated. Several crystalline derivatives of the periodate oxidation products of methyl 4:6-O-p-chlorobenzylidene-, 4:6-O-o-chlorobenzylidene-, and 4:6-O-o-bromobenzylidene-α-D-glucoside have been prepared. The reaction of the p-chloro-compound with aniline also gives a cyclic derivative but with cyclohexylamine an open chain derivative is formed.

California U., Berkeley.
MATRIX ISOLATION STUDIES: POSSIBLE INFRARED SPECTRA OF ISOMETRIC FORMS OF DIAZOMETHANE AND OF METHYLENE, CH_2, by Dolphus E. Milligan and George C. Pimentel. Rept. on Contract AF 49(638)1. 10 Sep 58, 20p. 27 refs. AFOSR-TN-58-818; AD-202 643.
Order from LC mi$2.40, ph$3.30 PB 138 170

The photolysis of diazomethane has been studied by the matrix isolation method. Argon and nitrogen matrices were used at 20°K. There is distinct infrared spectral evidence that unstable species have been detected spectroscopically: the production of stable products is inhibited until diffusion is permitted and a red glow accompanies diffusion. Among the identified products produced during diffusion are ethylene, propylene, methane, and polyethylene. The data suggest that methylene is present as well as a tautomeric structure of diazomethane. One of the absorptions observed at 1362 and 1114 cm^{-1} could be the bending mode of CH_2. (Author)

Florida U., Gainesville.
A STUDY OF POLYMERIZATION BY AN ALTERNATING INTRAMOLECULAR-INTERMOLECULAR CHAIN PROPAGATION MECHANISM, by George B. Butler and Martin D. Barnett. Final rept. for 16 Sep 56-15 Sep 59 on Contract AF 18(603)116. [1959] 15p. 4 refs. AFOSR-TR-59-146; AD-228 268.
Order from LC mi$2.40, ph$3.30 PB 145 435

The peroxide-initiated polymerization of diallyl- and diallyldimethylammonium bromide has given saturated, linear, soluble polymers containing recurring N-substituted piperidinium halide units alternating along the chain with methylene groups. The structure of the polymers was confirmed by degradative cleavage of the piperidinium rings. Acrylic anhydride has been polymerized in solution to afford a series of saturated, linear polymers whose molecular weights ranged from a few thousand up to 95,000. The properties of the polymers showed that polymerization had occurred by an intramolecular-intermolecular mechanism leading to a poly[3(5)-methylene-glutaric anhydride] structure. The poly[acrylic acid] obtained by hydrolysis of a poly[acrylic anhydride] was shown by X-ray diffraction patterns to have a much more regular structure than normal poly[acrylic acid]. Poly[methacrylic anhydride] has been prepared from methacrylic anhydride and found to have properties similar to poly[acrylic anhydride]. The methyl allyl, methyl 2-butenyl, and methyl 3-butenyl mixed esters of maleic and fumaric acid have been synthesized and polymerized in bulk to afford a series of low molecular weight polymers containing 37-77% residual unsaturation. This indicated that the approximate percent cyclization in the various polymers ranged from 23 to 63%. Although the cyclic portions of the polymers were composed predominately of six- and seven-membered lactone rings, the infrared spectra of poly[methyl allyl maleate] and poly[methyl 2-butenyl maleate] also showed the presence of five-membered lactone rings. Several unsymmetrical dienes were prepared and subjected to free-radical polymerization conditions. (Author)

Maryland U., College Park.
PREPARATION AND PROPERTIES OF SOME POLYPHENYLS, by G. Forrest Woods. Rept. on New Synthetic Methods, Contract AF 33(616)5063. Sep 59, 178p. 96 refs. WADC Technical rept. 59-496.
Order from OTS $3.00 PB 161 508

Methods of synthesis are reported for the introduction of ortho, meta, and para linkages in an order as may be desired in the polyphenyls and these methods have been applied to synthesize a number of types of polyphenyls. Certain physical properties of these substances were determined such as melting point, infrared spectra, ultraviolet spectra and behavior in vapor phase chromatography. A listing of the polyphenyls, along with certain of their physical properties, made in the course of this research is presented under the headings: (1) linear, (2) singly-branched and (3) doubly branched. Among these were three isomeric quinquephenyls each of which contained an ortho, meta and para linkage but which differed in the order of the linkages. For these three substances the melting point was the most sensitive while the ultraviolet and infrared spectra and behavior toward vapor phase

chromatography were the least sensitive of the four phenomena studied. Tables of aryl substituted cyclohexanones, cyclohexenones, and cyclohexadienes and bromopolyphenyls which were obtained as intermediates in the synthesis in the polyphenyl series are included.

Metcalf Research Lab., Brown U., Providence, R. I.
LEAST SQUARES REFINEMENT OF CENTROSYMMETRIC STRUCTURES INCLUDING ANISOTROPIC THERMAL PARAMETERS (I) [AND] A FIRST REFINEMENT OF THE STRUCTURE OF CUPRIC TROPOLONE (II) by Walter M. Macintyre. Technical rept. no. 5 on Contract Nonr-562(04). Jan 58, 19p. 5 refs. AD-156 119.
Order from LC mi$2.40, ph$3.30 PB 137 949

I. A program designed for the IBM704 computer is described. It carries out least squares refinement of crystal structure parmeters, including anisotropic temperature parameters, for centrosymmetric crystals. II. New measurements of the intensities of the (hkO) zone of reflections from cupric tropolone have been made. The structure has been refined by the method of least squares, using the program of I, in this zone. The results indicate that in cupric tropoline the ring is irregular and slightly puckered. (Author)

Pennsylvania State U., University Park.
CONDITIONS FOR STEREOSPECIFIC OLEFIN-MERCAPTAN RADICAL ADDITIONS, by Philip S. Skell and Richard G. Allen. Technical rept. on Contract AF 49(638)48. 8 Feb 60, 4p. 8 refs. AFOSR-TN-60-80.
Order from LC mi$1.80, ph$1.80 PB 145 667

Steric control of mercaptan addition is achieved by the rapid reaction of the diastereomerically related 3-methylthio-2-butyl radicals with hydrogen bromide, a reaction which is more rapid than the isomerization of the radicals.

Rochester U., N. Y.
THE PHOTOLYSES OF 2-PENTANONE AND 2-PENTANONE-1, 1, 1, 3, 3, -d_5, by P. Ausloos and E. Murad. Rept. on Contract AF 18(600)1528. 25 Nov 58, 15p. 14 refs. AFOSR-TN-58-529; AD-158 343.
Order from LC mi$2.40, ph$3.30 PB 138 144

The photolyses have been investigated at long wavelengths at maximum intensity of 3.7×10^{14} quanta/c.c./sec. and at short wavelengths. This investigation was carried out in the temperature range 25-83°C.

Texas U. [Austin].
THERMAL DECOMPOSITION OF BUTANE II, by James Cunningham and R. C. Anderson. Technical note 3 on Contract AF 18(603)142. Aug 58, 29p. 6 refs. AFOSR-TN-58-761; AD-201 860.
Order from LC mi$2.70, ph$4.80 PB 137 539

Experimental studies of the thermal decomposition of butane have been extended to additional temperatures and to a wider range of flow velocities. The effects of increased surface, and of added oxygen and ethylene oxide were also investigated. (See also PB 133 293)

Physical Chemistry

Aerojet-General Corp., Azusa, Calif.
APPLICATION OF SURFACE DECOMPOSITION KINETICS TO DETONATION OF AMMONIUM NITRATE, by W. H. Andersen and R. F. Chaiken. Rept. on Contract AF 18(603)74. 19 June 58, 13p. 12 refs. TN-26; AFOSR-TN-58-617; AD-162 146.
Order from LC mi$2.40, ph$3.30 PB 137 773

Kinetic rate data for the linear surface gasification (pyrolysis) of ammonium nitrate is used in conjunction with the Eyring grain-burning theory to calculate the detonation reaction time for ammonium nitrate. A new grain-burning mechanism is presented which results in a reaction time for detonating ammonium nitrate that is consistent with the one calculated by means of the nozzle and curved-front diameter theories. The implications of the new model with respect to low-velocity detonations in mixtures of granular explosives is discussed. (Author)

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
A STUDY OF THE INTERACTION BETWEEN CARBON AND DISSOCIATED GASES, by W. G. Zinman. Rept. on [Contract AF 04(647)269]. 5 Nov 59, 15p. 23 refs. Technical Information Series R59SD457.
Order from LC mi$2.40, ph$3.30 PB 145 183

The reaction of active nitrogen (atomic nitrogen) with carbon at 800°C was studied. The consistent failure to obtain measurable amounts of cyanogen as a reaction product showed that the collision efficiency of cyanogen formation was less than 10^{-4}. On the other hand, when nitrogen containing 30 ppm of hydrogen was activated, significant amounts of HCN were obtained. These results indicate that atomic hydrogen promotes a reaction between atomic nitrogen and carbon on at least one out of every thousand collisions. A mechanism accounting for these results is postulated. (Author)

Alabama U., University.
CONDUCTANCE OF THE HEXAFLUOCOMPLEXES OF THE FOURTH GROUP, by E. L. Grove and Robert Schmitt. Rept. on Contract AF 18(600)1567. 25 July 59, 58p. 15 refs. AFOSR-TN-59-616; AD-217 403.
Order from LC mi$3.60, ph$9.30 PB 145 639

The purpose of this research was to investigate the variation of equivalent conductance with concentration for eighteen alkali-hexafluocomplex solutions. The electrolytes used were the potassium, rubidium, and cesium hexafluocomplexes formed with silicon,

germanium, tin, titanium, zirconium and hafnium. During the progress of this work it was also found necessary to measure the pH of all the solutions investigated, to develop methods of preparation for some of the compounds, and to determine accurately the solubility at 25°C of all the salts prepared.

Arkansas U., Fayetteville.
THE INFLUENCE OF SPECTRAL RADIATIONS ON SELECTED SOLIDS UNDER BOMBARDMENT BY ELECTRON AND ION STREAMS, by Z. V. Harvalik. Final rept. for 10 Dec 54-9 Oct 56 on Contract DA 44-009-eng-2439. 9 Oct 56. 23p. 15 refs. AD-124 248.
Order from LC mi$2.70, ph$4.80 PB 137 722

A report is made of the attempt to duplicate certain experiments dealing with decomposition of explosives in order to obtain information relative to a theory of interaction phenomena. The behavior of metastable substances was studied under the exposure of optical radiations alone. Lead azide was employed in the investigations. The purity criteria of the substances were investigated, and a thermolysis and a photolysis were made of lead azide. A hypothesis on the spontaneous detonation of lead azide was tested. Metal azide emulsions were produced and photographed. A discussion is presented of the theory and experiments undertaken in the photolyses of crystalized (PB 137 723) and amorphorus lead azides.

Battelle Memorial Inst., Columbus, Ohio.
A KINETIC STUDY OF THE THERMAL DECOMPOSITION OF TETRAPHENYLSILANE, TRIPHENYLPHOSPHINE, DIPHENYL SULFIDE DIPHENYL SULFOXIDE, AND DIPHENYL SULFONE, by Arthur Levy and Charles J. Ambrose. Rept. for 1 May 57-30 Apr 59 on Contract AF 33(616)5217. Oct 59, 41p. 11 refs. WADC Technical rept. 59-560.
Order from OTS $1.25 PB 161 498

The gas phase decomposition kinetics of diphenyl sulfoxide, diphenyl sulfone, triphenylphosphine, diphenyl sulfide, and tetraphenylsilane were studied between 350° and 650°C. The compounds increase in stability in the order presented. The decompositions are first order and the principal decomposition products common to all five compounds are benzene and high molecular weight polymers. Although the mechanism for the formation of benzene is not fully established by these studies, a specific relationship exists between the number of benzene molecules formed and the number of phenyl groups in the starting compound. The kinetics suggest a molecular rearrangement mechanism, although a free-radical mechanism is not entirely excluded.

Cobb Chemical Lab., U. of Virginia, Charlottesville.
MOLECULAR DIMENSION AND COMPLEX FORMATION WITH HYDROGEN PEROXIDE, by Martin E. Everhard and Paul M. Gross, Jr. Final rept. for 16 Jan-31 Aug 59 on Contract DA 36-034-ORD-2831. 1 Sep 59, 35p. 2 refs. OOR rept. 2295. 1-C.
Order from LC mi$3.00, ph$6.30 PB 145 174

Columbia U., New York.
PARAMAGNETIC RESONANCE ABSORPTION SPECTROSCOPY, by George K. Fraenkel. Rept. no. 16 (Final) 1 Apr 55-30 Sep 59 on Contract AF 18(600)1390. [1959] 11p. 3 refs. CU-16-[59]-1390-Chem.; AFOSR-TR-59-201; AD-230 591.
Order from LC mi$2.40, ph$3.30 PB 145 523

Du Pont de Nemours, E. I., and Co., Wilmington, Del.
THE PURIFICATION OF HELIUM GAS, by E. Field and A. J. Wells. Formal rept. on Contract NOa(s)343. 14 July 43, declassified. 36p.
Order from LC mi$3.00, ph$6.30 PB 137 533

The work covered by this report discloses two methods by which helium gas may be freed of such impurities as nitrogen and oxygen and one method by which it may be freed of hydrogen.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
THE MATHEMATICAL FORMULATION OF RADIATIVE TRANSFER PROBLEMS FOR NON-UNIFORM GASES IN TERMS OF DERIVATIVES OF HEMISPHERICAL EMISSIVITIES, by A. Thomson and S. S. Penner. Technical rept. no. 30 on Contract Nonr-220(03). Feb 59, 17p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 145 258

A method is described for the formulation of radiative transfer problems involving non-uniform gases. Our procedure is simpler to use than the conventional approach which has been described, for example, by Chandrasekhar, in those cases in which emissivity compilations are available. (Author)

Indiana U., Bloomington.
AN EXPERIMENTAL INVESTIGATION ON THE CHEMISTRY AND INTERCONVERSION OF BORON HYDRIDES, by Riley Schaeffer. Rept. for 1 July 58-30 June 59 on Contract AF 33(616)5827. July 59, 51p. 25 refs. WADC Technical note 59-258.
Order from OTS $1.50 PB 161 479

A novel method for preparing diborane by radical catalyzed reaction of trichloroborane and monosilane is described. Experimental studies of various steps in the thermal conversion of diborane to pentaborane-11 are described. These include a study of the isotope effect on diborane pyrolysis, reaction of a possible triborane with diborane and isolation of tetraborane-8 carbonyl as an intermediate in tetraborane pyrolysis. Physical properties of tetraborane-8 carbonyl including vapor pressures, infrared spectrum, NMR spectrum and mass spectrum are reported. Reaction of bridge labelled decaborane with acetonitrile released hydrogen of deuterium content corresponding closely to release of one bridge and one non-bridge (probably 5, 7, 8, 10) proton. Reaction of bridge labelled decaborane with CH_3MgI produced about 25% CH_3D. Attack at the top of the molecule is indicated. A new amine derivative of a borane has been obtained by treatment of $(CH_3)_3NB_3H_7$ with hydrogen chloride and diborane.

Johns Hopkins U., Baltimore, Md.
THE EFFECT OF SUBSTITUTION ON THE IONIZATION POTENTIALS OF FREE RADICALS AND MOLECULES. I. A NEW SET OF CONSTANTS, THE δ_K VALUES, by Joyce J. Kaufman and W. S. Koski. Rept. on Contract AF 18(600)1526. [1960] 27p. 43 refs. AFOSR-TN-60-52; AD-231 045.
Order from LC mi$2.70, ph$4.80 PB 145 686

Several new applications of ionization potentials are presented.

Lund U. (Sweden).
EQUILIBRIUM STUDIES ON DISULFIDES BY USE OF VAPOR PHASE CHROMATOGRAPHY, by C. J. Olander and S. Sunner. Technical note no. 1 on Contract AF 61(052)46. 1 June 59, 6p. 6 refs. AFOSR-TN-59-731.
Order from LC mi$1.80, ph$1.80 PB 145 610

Some general aspects are given on the use of vapor phase chromatographic technique for the determination of equilibrium constants. The usefulness has been demonstrated for the disproportionation reaction between dimethyl and diethyl disulfide. (Author)

Lund U. (Sweden).
EXPLORATORY STUDIES ON THE PHOTOLYSIS OF DISULFIDES IN AN ORGANIC MATRIX AT 77°K, by Kjell Rosengren, S. Sunner and Dietrich Timm. Technical note no. 2 on Contract AF 61(052)46. 1 Aug 59, 15p. 6 refs. AFOSR-TN-59-572; AD-217 006; AD-230 183.
Order from LC mi$2.40, ph$3.30 PB 145 677

In an exploratory investigation aiming at the determination of "bond formation" energies by measuring the heat effect accompanying the recombination of radicals trapped in an organic matrix at 77°K, the photolysis of disulfides has been studied.

Massachusetts Inst. of Tech., Cambridge.
THE CONFIGURATION OF THE TRIIODIDE GROUP IN TETRAPHENYL ARSONIUM TRIIODIDE, $(C_6H_5)_4AsI_3$, by R. C. L. Slater. Technical rept. no. 2 on Contract AF 18(603)84. 26 Oct 58, 23p. 24 refs. AFOSR-TN-58-834; AD-202 919.
Order from LC mi$2.70, ph$4.80 PB 138 134

Tetraphenyl arsonium triiodide crystallizes with the space group symmetry P 2/n. There are two formula weights of $(C_6H_5)_4AsI_3$ in the unit cell, for which a = 15.34 ± .01Å, b = 7.63 ± .01Å, c = 10.63 ± .01Å and $\beta = 93.4°$. A trial structure was deduced from two dimensional Patterson and Fourier series, and refined by Fourier difference series. The triiodide ion in this crystal is equibonded. The bond length is 2.90 ± .02Å. Triiodide ions measured in crystals having cations which are small compared to $(C_6H_5)_4As^+$ have non-equivalent bond lengths. The small differences which have been reported in the configuration of the I_3^- ion in different crystals are discussed with reference to the crystal environments. An explanation based on the general behavior of a simple linear triatomic system is suggested. (Author)

Milan U. (Italy).
RHENIUM COORDINATION COMPOUNDS, by Lamberto Malatesta. Technical (scientific) note no. 2 on Contract AF 61(052)83. 31 Oct 59, 16p. 5 refs. AFOSR-TN-59-1081.
Order from LC mi$2.40, ph$3.30 PB 145 675

New coordination compounds of rhenium(I), rhenium(II), and rhenium(III) with halogens, triphenylphosphine (PR_3), and carbon monoxide are described.

Naval Ordnance Lab., White Oak, Md.
A STUDY OF THE POLYMERIZATION OF EPOXIDE POLYMERS BY ELECTRICAL RESISTIVITY TECHNIQUES, by R. W. Warfield and M. C. Petree. 25 Apr 59, 20p. 25 refs. NAVORD rept. 6657; AD-220 209.
Order from LC mi$2.40, ph$3.30 PB 145 820

Electrical resistivity measurements made isothermally during polymerization have been used to study the bulk polymerization of both amine and acid anhydride polymerized epoxide polymers. Whenever possible kinetic data have been calculated. The reactions with the amines proceed at a much greater rate and in a different manner than when the polymerization is conducted with maleic anhydride. The results of this study indicate that resistivity measurements are sensitive to the extent of polymerization and can be used to follow the rate of polymerization. (Author) (See also PB 145 822)

Polacoat, Inc., Blue Ash, Ohio.
PHOTOTROPY, A LITERATURE REVIEW, by Glenn H. Brown. Rept. on Health Hazards of Materials and Radiation, Contract AF 33(616)5469. Dec 59, 62p. 171 refs. WADC Technical rept. 59-436.
Order from OTS $1.75 PB 161 519

This review of phototropic phenomenon literature is limited to the articles referenced in Chemisches Zentralblatt from 1880 to 1910 and in Chemical Abstracts from 1907 to 1955. Various books dealing with photochemistry are also reviewed. (Author) (See also PB 161 433)

Polytechnic Inst. of Brooklyn, N. Y.
THE ADSORPTION OF POLYDIMETHYL SILOXANES ON SOLIDS, by Robert Perkel and Robert Ullman. Technical rept. no. 1 on Contract Nonr-839(19). 31 Jan 58, 47p. 14 refs. AD-200 520.
Order from LC mi$3.30, ph$7.80 PB 137 958

A comparison was made of the adsorptive properties of the carbon chain polymers with a siloxane chain polymer, where the polar constituents have been transferred to the backbone. The adsorbents chosen

were Fe powder prepared from iron carbonyl and ground pyrex glass. The Fe powder was chosen so that a comparison could be made between polyvinyl acetate and polydimethylsiloxane. IR absorption spectra were used to analyze solutions for polymers. The rate of adsorption was studied to determine the time necessary to reach equilibrium. Equilibrium was established in about 1 hr with Fe and in about 2 min with glass. High molecular weight polymer appeared to be adsorbed first and was then rapidly replaced by smaller molecules. Isotherms were obtained with constant quantities of Fe powder while varying the concentration of silicone solution in benzene distilled over Na. Water had an inhibiting effect on the adsorption. The adsorption of silicone on glass appeared to be more sensitive to molecular weight variation than adsorption onto Fe; the affinity decreased for each surface with molecular weight. Monomeric vs polymeric adsorption was compared by studying 2 isotherms of a linear dimer of various concentration on Fe and glass. A plot of the change in concentration as initial concentration indicated that if any adsorption occurred it was less than could be detected by the method of analysis used. Desorption studies were undertaken with glass and Fe and benzene and heptane. Considerable desorption occurred with Fe powder but attempts to desorb from glass by using benzene and heptane were unsuccessful.

Princeton U. [N. J.]
AN APPROXIMATE CALCULATION OF EQUILIBRIUM CONDITIONS BEHIND SHOCK WAVES IN THE NOBLE GASES, by G. B. F. Niblett and Anne Kenny. Rept. on Contract N6ori-105(02). Oct 57, 17p. 4 refs. Technical rept. II-24; AD-144 571.
Order from LC mi$2.40, ph$3.30 PB 137 702

Graphs are presented to show the degree of ionization α, the temperature T_2 and the density ratio ρ_2/ρ_1 at equilibrium behind a shock of Mach number M in the noble gases. The calculations are for initial pressures of 0.1, 1.0 and 5.0 cms of mercury and an initial temperature of 296°K. It is assumed there is no heat loss and no electronic excitation. At the two highest initial pressures the results for helium, neon, krypton and xenon (dotted lines) have been obtained from the argon results by an approximate method.

Princeton U., N. J.
METAL COMBUSTION PROCESSES, by Irvin Glassman. Technical rept. on Contract AF 18(600)1527. Aug 59, 43p. 92 refs. Aeronautical Engineering Lab. rept. no. 473; AFOSR-TN-59-1083; AD-228 566.
Order from LC mi$3.30, ph$7.80 PB 145 531

Some preliminary conclusions on burning characteristics of the light metallic elements are presented. These conclusions are based on fundamental physical considerations and not on experimental results.

Purdue U., Lafayette, Ind.
THE THERMODYNAMIC PROPERTIES OF TECHNETIUM AND RHENIUM COMPOUNDS. VII. HEATS OF FORMATION OF RHENIUM TRICHLORIDE AND RHENIUM TRIBROMIDE. FREE ENERGIES AND ENTROPIES, by J. P. King and J. W. Cobble. Rept. on Contract AF 18(600)1525. Oct 59, 11p. 19 refs. AFOSR-TN-59-968.
Order from LC mi$2.40, ph$3.30 PB 145 532

The heats of oxidation of $ReCl_3$ (c) and $ReBr_3$ (c) by basic hypochlorite have been determined. From these data the heats of formation at 25°C, have been calculated to be: $ReCl_3$ (c), -63.1 ± 0.8 kcal. $mole^{-1}$ and $ReBr_3$ (c), -39.9 ± 0.8 kcal. $mole^{-1}$. Free energy and entropy estimates are also given. (Author) (See also PB 124 141)

Research Inst., Temple U., Philadelphia, Pa.
AN EXPERIMENTAL DETERMINATION OF THE DENSITIES OF MOLTEN METAL FLUORIDES IN THE RANGE OF 1600° TO 2500°K, by A. D. Kirshenbaum and J. A. Cahill. Technical note no. 9 on Study of Ultra High Temperature, Contract AF 18(600)1475. 30 Apr 59, 51p. 12 refs. AFOSR-TN-59-844.
Order from LC mi$3.60, ph$9.30 PB 145 363

Using a graphite crucible and a tungsten sinker, the liquid densities of the alkaline earths and two rare earth fluorides were determined by the loss in weight of an immersed sinker method. The liquid molar volumes of the alkaline earth fluorides exhibit a linear relationship when plotted against period in the Periodic Table.

Research Inst., Temple U., Philadelphia, Pa.
PREMIXED FLAMES OF CYANOGEN AND THE ENDOTHERMIC OXIDES OF NITROGEN AND THE PREMIXED, PREHEATED OXY-CYANOGEN FLAME, by Charles S. Stokes, Robert P. M. Werner and others. Technical note no. 7 on Study of Ultra High Temperatures, Contract AF 18(600)1475. 2 Sep 58, 27p. 16 refs. AFOSR-TN-58-810; AD-202 355.
Order from LC mi$2.70, ph$4.80 PB 137 838

The combustion of cyanogen with the oxides of nitrogen, namely N_2O, NO and NO_2, has been studied and the stoichiometry of the nitric oxide cyanogen flame experimentally verified. Theoretical flame temperatures of the reactions between cyanogen and the oxides of nitrogen were calculated. Burning velocity was measured as a function of temperature for the oxy-cyanogen flame and as a function of concentration for the combustion of cyanogen with the oxides of nitrogen. The candlepower of the oxy-cyanogen flame has been measured over a range of combustible compositions. (Author)

Research Inst., Temple U., Philadelphia, Pa.
STUDY OF ULTRA HIGH TEMPERATURES, by A. V. Grosse, comp. by C. S. Stokes. Final rept. for 1 May 55-30 Apr 59 on Contract AF 18(600)1475. 30 Apr 59, 31p. 31 refs. AFOSR-TR-59-168.
Order from OTS $1.00 PB 161 460

Covers such topics as: The production of high temperature flames; Systems of carbon, nitrogen and oxygen; The cyanogen-oxygen flame as a high temperature tool; Systems using fluorine; The fastest burning flame - the premixed hydrogen-fluorine flame; Systems using ozone; Imaging of the oxygen-aluminum flame and its use as an artificial sun furnace; Two phase reactions at high temperatures; Combustion of beryllium in oxygen; The temperature of the zirconium-oxygen flame; An experimental determination of the densities of molten metal fluorides in the range of 1600° to 2500°K; Preparation of carbon-phosphorus compounds.

Rochester U., N. Y.
THE FLUORESCENCE OF BIACETYL VAPOR, by Julian Heicklen. Rept. on Contract AF 18(600)1528, 12 Sep 58, 16p. 7 refs. AFOSR TN-58-846; AD-203 336.
Order from LC mi$2.40, ph$3.30 PB 138 246

The fluorescence and phosphorescence of biacetyl have been studied at 40° as a function of pressure and incident wavelength from 4358A to 3020A. A mechanism is proposed which explains both the light emission and the photochemistry.

Royal Inst. of Tech. (Sweden).
APPLICATION OF A LIQUID DISTRIBUTION METHOD TO THE STUDY OF THE HYDROLYSIS OF AG^+, by P. J. Antikainen and David Dyrssen. Technical note no. 4 on Contract AF 61(052)162. 30 July 59, 20p. 9 refs. AFOSR-TN-59-664.
Order from LC mi$2.40, ph$3.30 PB 145 612

The distribution of silver at 25°C between solutions of quinoline (Q) in benzene and 3 M $Na(ClO_4, OH)$ has been studied as a function of $[Q]_{org}$, $[OH^-]$ and the silver concentration.

Royal Inst. of Tech. (Sweden).
STUDIES ON THE HYDROLYSIS OF METAL IONS. POTENTIOMETRIC STUDY ON THE ARGENTATE (I) COMPLEX IN ALKALINE SOLUTION, by P. J. Antikainen, Sirkka Hietanen, and Lars Gunnar Sillen. Technical note no. 3 on Contract AF 61(052)162. 27 July 59, 17p. 9 refs. AFOSR-TN-59-663.
Order from LC mi$2.40, ph$3.30 PB 145 613

The composition of the argentate (I) complex formed in alkaline solutions of silver oxide has been studied by emf titrations with constant ionic medium) (0.95 and 12.6 M NaOH, 1.15 and 11.5 M KOH) using Ag-AgI electrodes. It is concluded that the formula of the complex is $Ag(OH)_2^-$. No evidence has been found for the presence of the polynuclear argentate complexes proposed by some previous workers. The solubility product of $Ag_2O(s)$ in 3 M $Na(ClO_4)$ at 25°C was determined as $\log K_{SO} = \log [Ag^+] [OH^-] = -7.42 \pm 0.02$.

Stanford Research Inst., Menlo Park, Calif.
THE HILL REACTION AS A MODEL FOR CHEMICAL CONVERSION OF SOLAR ENERGY, by Rudolph J. Marcus. Technical rept. no. 15 on Contract AF 18(603)07. 1 Dec 59, 9p. 6 refs. AFOSR-TR-59-208.
Order from OTS $0.50 PB 161 462

The possibility of storing solar energy for use during dark periods by decomposition of water into its elements was explored along two lines. One of these consisted of taking advantage of the electron transfer spectra of inorganic ions. These were surveyed and listed, together with chemical and thermodynamic correlative data. The other method consisted of a study of various Hill reaction oxidants. Two new electron acceptors, $Co(C_2O_4)_3^{-3}$ and Cr^{+3}, were found to be active in the Hill reaction.

Stanford Research Inst., Menlo Park, Calif.
ION-MOLECULE REACTIONS IN MASS SPECTROMETRIC STUDIES OF ALKALI HALIDE SALTS, by Thomas A. Milne. Technical note no. 5 on Contract AF 49(638)89. Dec 59, 6p. 8 refs. SRI Project no. 2024; AFOSR-TN-59-1331; AD-231 607.
Order from LC mi$1.80, ph$1.80 PB 145 641

An experiment was made to demonstrate directly and sensitively the contribution of ion-molecule reactions to the observed intensities of M_2Cl^+ under the experimental conditions used. A double orifice cell containing pure KCl in one chamber and pure NaCl in the other was used. A Bendix time-of-flight spectrometer with a 2-channel pulse counter and electron multiplier was utilized to detect individual ions formed. Some $NaKCl^+$ was found; no clear evidence was noted of an ion-molecule reaction contribution to $NaKCl^+$. An estimation was made that if ion-molecule reactions were the sole source of M_2X^+, the ratio $Na_2Cl^+/NaKCl^+$ should be about 0.5. The conclusion was drawn that under these experimental conditions ion-molecule reactions account for less than 0.1% of the observed M_2X^+.

Stanford Research Inst., Menlo Park, Calif.
NEW ELECTRON ACCEPTORS FOR THE HILL REACTION. II: CHROMIC ION, by Rudolph J. Marcus. Technical note no. 3 (Rept. no. 14) on Contract AF 18(603)7. 1 Dec 59, 11p. 6 refs. AFOSR-TN-59-1321.
Order from LC mi$2.40, ph$3.30 PB 145 671

A new electron acceptor for the Hill reaction, chromic ion, has been found on the basis of previous work on the absorption spectra of Hill reaction oxidants. Because of its low solubility at physiological pH, this oxidant must be used in conjunction with a secondary oxidant (MnO_2), an excess of which will maintain a constant, but small, concentration of chromic ion by immediate reoxidation of the reduction product. No reoxidation appears to take place in the absence of MnO_2, either by reduction of water or by ultraviolet photooxidation of the reduction product. (Author)

Stanford U., Calif.
THE INFLUENCE OF EXCHANGE INTERACTION ON PARAMAGNETIC RELAXATION TIMES, by J. P. Goldsborough, M. Mandel and G. E. Pake. Technical note no. 3 on Contract AF 18(603)131. Nov 59, 11p. 10 refs. AFOSR-TN-59-1245.
Order from LC mi$2.40, ph$3.30 PB 145 313

Technical U., Trondheim (Norway).
AN ELECTRON DIFFRACTION OF THE MOLECULAR STRUCTURE OF ALLENE, by A. Almenningen, O. Bastiansen, and M. Tratteberg. Technical note on Contract AF 61(052)72. 31 Aug 59, 10p. 8 refs. AFOSR-TN-59-704.
Order from LC mi$1.80, ph$1.80 PB 145 611

The electron diffraction sector method was used to determine the structure of allene vapor. The observed molecular parameters are the following: C-H: 1.0816 Å (u = 0.0795 Å), C=C: 1.3116 Å (u = 0.0390 Å), C_1C_3: 2.617 Å (u = 0.0519 Å) and < H-C=C: 120.8°. The C_1C_3 distance was found to be shorter than twice the C=C distance. This can be explained by out-of-linearity vibrations. (Author)

University of Southern California, Los Angeles.
PHOTOIONIZATION INDUCED ION-MOLECULE REACTIONS IN A MASS SPECTROMETER, by Gilbert R. Cook, J. A. R. Samson and G. L. Weissler. Technical rept. on Contract AF 19(604)2049. 1 June 59, 88p. 57 refs.
Order from LC mi$4.80, ph$13.80 PB 145 185

The usual method of ionizing the neutral molecule X is by electron impact, but in this research, X^+ has been produced by photoionization using monoenergetic photons from a grating monochromator. Photoionization has been found to possess several advantages over electron impact methods. The primary aim of this research was to look for the occurrence of ion-molecule reactions and to determine their reaction rate and cross section. The gases studied were hydrogen, methane, and a one-to-one mixture of hydrogen and nitrogen, and the observed product ions detected were H_3^+, CH_5^+, and N_2H^+, respectively. Of secondary interest were the appearance potentials of ions and the dependence of ion intensities on photon energy.

Uppsala U. (Sweden).
THE TWO-ELECTRON HOMOPOLAR CHEMICAL BOND; HYDROGEN, by Harrison Shull. Technical note no. 17 on Contract AF 61(514)1200, continuation of Contract AF 49(638)318. 15 Sep 58, 45p. 46 refs.
Order from LC mi$3.30, ph$7.80 PB 145 328

The correlation energy of the hydrogen molecule is considered as related to the He atom and to the infinitely separated atoms, and it is shown that one can obtain a consistent qualitative picture of the electron-electron interaction in the molecular bond in this way. Previous approximate wave functions for hydrogen are analyzed quantitatively into approximate natural spin orbital functions with particular attention to the corresponding occupation numbers. The analysis demonstrates (1) the very great similarity of all such trial wave functions, (2) the largely molecular orbital nature of the wave function, (3) the great similarity between the molecular orbital and valence bond functions, and (4) the necessity for allowing for angular correlation of the electrons. Finally the analysis shows very clearly that the concepts of "covalent" and "ionic" "character", at least as applied to the two-electron homopolar chemical bond, have no real significance and should be abandoned. (Author)

Watertown Arsenal Labs., Mass.
THERMAL DECOMPOSITION OF HYDRAZINE, by Arthur Kant and William J. McMahon. Oct 59, 8p. 8 refs. Technical rept. no. WAL TR 804/20; AD-228 313.
Order from LC mi$1.80, ph$1.80 PB 145 221

The thermal decomposition of gaseous hydrazine is at least in part heterogeneous. In a quartz or glass vessel the reaction proceeds according to the equation $3N_2H_4 = 4NH_3 + N_2$. A study of the isotopic composition of molecular nitrogen from the thermal decomposition of hydrazine enriched in $H_2N^{15}\text{-}N^{14}\text{-}H_2$ shows that no randomization of the nitrogen atoms during the reaction. Lack of randomization clearly signifies that the N-N bond existing in molecular nitrogen has not broken during the process of decomposition. Reaction mechanisms are discussed in the light of this result. It is shown that free radical mechanisms are either inconsistent with the non-randomization result or are ruled out by other considerations. Results of the randomization studies are consistent with a previous proposal that the decomposition of hydrazine occurs through a surface adsorbed activated complex. (Author)

EARTH SCIENCES

Climatology and Meteorology

Allied Research Associates, Inc., Boston, Mass.
THE MOTION AND PREDICTABILITY OF PRECIPITATION LINES, by Ronald J. Boucher and Raymond Wexler. Scientific rept. no. 2 on Contract AF 19(604)5204. 14 Oct 59, 39p. 6 refs. AFCRC-TN-59-614.
Order from LC mi$3.00, ph$6.30 PB 145 765

Analysis of radar film data from New England and the midwest has yielded new information on such characteristics of precipitation lines as their speed and its variability and the relation of line motion to upper winds, the direction of motion, the line lifetimes and the regions of origin and decay. The mechanics of line motion are discussed and an expression derived taking into account advection and development. A series of objective tests on the line predictability leads to a suggested technique for forecasting the arrival of a line at a particular point. (Author)

Daniel Guggenheim Airship Inst., U. of Akron, Ohio.
STUDY OF NATURAL WIND AND COMPUTATION OF THE AUSTAUSCH TURBULENCE CONSTANT, by P. O. Huss and D. J. Portman. Technical rept. no. 1 on Contract N6onr-276, T. O. 1. Jan 48, 88p. 24 refs. DGAI Rept. no. 149; ATI-99 758.
Order from LC mi$4.80, ph$13.80 PB 146 232

This paper contains a description of the micrometeorological station set up by the Daniel Guggenheim Airship Institute. The purpose of the investigation is to obtain simultaneous meteorological data at several levels of a 350 foot tower and to study the variation of the Austausch Turbulence Constant.

Allied Research Associates, Inc. [Boston, Mass.]
METHODS OF PRESENTATION OF TIME-HEIGHT REFLECTIVITY PROFILES, by Raymond Wexler. Scientific rept. no. 3 on Contract AF 19(604)5204. Oct 59, 25p. 3 refs. AFCRC-TN-59-615.
Order from LC mi$2.70, ph$4.80 PB 145 256

Two methods for presenting vertical reflectivity profiles are evaluated for possible participation in Weather System 433L. Interpretations of the physical processes and indication of trends are made for four cases. A code for teletype transmission of the data for the two methods is presented. (Author)

Deutscher Wetterdienst, Offenbach (West Germany).
MEDIUM-RANGE FORECASTING TECHNIQUES FOR CENTRAL EUROPE, PART II, by A. Hofmann, H. Diehl and others. Final rept. on Contract AF 61(514)954. Sep 57, 48p. 15 refs. AFCRC-TR-58-225; AD-152 505.
Order from LC mi$3.30, ph$7.80 PB 137 523

The Medium Range Forecasting Techniques as applied in Central Europe is divided into two parts, the Extended Range Forecast and the Sliding Forecast. The last one goes towards the Long Range Forecast as a monthly or seasonal one. The extended forecast as demonstrated in this paper is a combination of an extrapolation method with a statistical method. The method of extrapolation uses the isopleths of surface pressure and pressure changes respectively in a system of longitude and time for constant latitudes. The statistical method uses multiple correlation tables for the surface pressure changes as predictands. The sliding forecast methods are mainly restricted to the winter season. All three methods were applied to the winter 1956/57 and the forecasting area of Central Europe. 43 statistical relations of 49 were successful (88%). The success of all sliding forecasts in the winter 1956/57 as a combination of all three methods was 78%.

Deutscher Wetterdienst, Frankfurt (West Germany).
THE ZONAL WIND COMPONENT IN THE ATLANTIC-EUROPEAN SECTOR AS INFLUENCED BY SHORT-SCALE FLUCTUATIONS IN SOLAR ACTIVITY, by H. Trenkle. Scientific rept. no. 2 on Contract AF 61(514)954C. Jan 57, 14p. 20 refs. AFCRC-TN-57-299; AD-117 192.
Order from LC mi$2.40, ph$3.30 PB 137 522

After an introduction to pertinent literature, verification is produced on the basis of the observation period from January 1, 1948 to August 31, 1956, that the zonal component of the geostrophic wind in 500 millibars (U_{g12_0}) in the Atlantic-European sector (60°W - 60°E) along 55°N exhibits characteristic fluctuations on the days subsequent to isolated maximum sunspot levels that were preceded by a vigorous rise of relative sunspot numbers (R) of $\geq$ 40 units. In this process the circulation factors on the reference date play a decisive part. (Author)

Harvard U., Cambridge, Mass.
SERVICES AIDING THE STUDY AND RECORDING OF METEOROLOGICAL PHENOMENA IN CORRELATION WITH RADAR REFLECTIVITY PATTERNS OF PRECIPITATION AS OBSERVED AT OR ADJACENT TO THE BLUE HILL METEOROLOGICAL OBSERVATORY, MILTON, MASS., by George K. Thompson. Rept. no. 5 (Final) on Contract AF 19(604)4942. 31 Oct 59, 17p. AFCRC-TR-59-400.
Order from LC mi$2.40, ph$3.30 PB 145 561

Imperial Coll. of Science and Tech., London (Gt. Brit.)
RESEARCH ON THE PROPERTIES OF CLOUD SYSTEMS, by F. H. Ledlam and L. I. Miller. Final rept. on Contract AF 61(514)1292. Mar 59, 88p. 29 refs. AFCRC-TR-59-286.
Order from LC mi$4.80, ph$13.80 PB 145 104

In the first part of the report the use of cloud observations in modern forecasting practice is discussed. In the later part of the report methods of forecasting the occurrence of high cloud systems are briefly discussed.

Laboratory of Climatology, Centerton, N. J.
SUMMARY OF CLIMATIC OBSERVATIONS, 1956, by C. W. Thornthwaite and J. R. Mather. Technical rept. no. 4 on Contract Nonr-1617(00). 1957, 112p. Publications in Climatology, vol. 10, no. 2; AD-218 119.
Order from LC mi$6.00, ph$18.30 PB 138 183

The data presented in this report continue the records originally published in Interim Reports of "Micrometeorology of the Surface Layer of the Atmosphere," the Johns Hopkins University, Laboratory of Climatology, Seabrook, New Jersey, January 2, 1948 through June 30, 1952. The text of the report includes only that information considered necessary for an understanding of the data. The reader is referred to earlier reports for additional information regarding the instrumentation and techniques employed.

Little, Arthur D., Inc., Cambridge, Mass.
PRELIMINARY ATTEMPTS TO INFLUENCE CONVECTIVE ELECTRIFICATION IN CUMULUS CLOUDS BY THE INTRODUCTION OF SPACE CHARGE INTO THE LOWER ATMOSPHERE; PAPER PRESENTED AT CONFERENCE ON ATMOSPHERIC ELECTRICITY, WENTWORTH-BY-

THE-SEA, N. H., MAY 20-23, 1958, by Bernard Vonnegut and Charles B. Moore. Rept. on Contract Nonr-1684(00). [1958] 29p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 145 609

If electrification of cumulus clouds is initiated by the fair-weather space charge in the air from which they develop, it should be possible to influence their electrification by introducing sufficient amounts of electric charge into the lower atmosphere. In preliminary experiments carried out during the spring and summer of 1957 at Jacksboro, Texas, approximately one milliampere of negative electricity was released from a wire 7 km long and 10 m above the ground. The resultant negative space charge was sufficient to reverse the fair-weather electric field for about 8 km downwind. An electric field meter 7 km downwind showed that when low level cumuli growing from the charged air passed overhead, the field became more strongly anti-fair-weather. These observations indicate that the negative space charge was carried by updrafts into the cloud. Because of lack of adequate instrumentation, we could not determine the effect of the charged air on the subsequent electrical development in the cloud. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
RESULTS OF AN EXPERIMENT TO DETERMINE INITIAL PRECEDENCE OF ORGANIZED ELECTRIFICATION AND PRECIPITATION IN THUNDERSTORMS: PAPER PRESENTED AT CONFERENCE ON ATMOSPHERIC ELECTRICITY, WENTWORTH-BY-THE-SEA, MAY 20-23, 1958, by C. B. Moore, Bernard Vonnegut and Alexander T. Botka. Rept. on Contracts Nonr-1684(00) and AF 19(604)1920. [1958] 57p. 25 refs.
Order from LC mi$3.60, ph$9.30 PB 145 608

Observations of summer thunderstorms developing over Mt. Withington, New Mexico, show that electrification begins early in the cloud's development. Measurements within and above the cloud show that electric charge accumulations similar in polarity to those of the mature storm begin to form before any echo can be seen with an X-band radar and before any electrical perturbations can be detected on the mountain summit beneath the cloud. Measurements of potential gradient were made within the cloud with radiosondes supported on tethered balloons. It was found that the gradient within the cloud was far larger than that outside the cloud and that it reached values as high as 20 v cm^{-1} before the appearance of the radar echo. Measurements made from an airplane flying over the top of the growing cloud showed that here the fair-weather potential gradient reversed before any radar echo could be seen. The rapid rise of the cloud tops and the tension on the line holding the tethered balloon showed that the development of the initial electrical activity was closely related to convective activity. The initial radar precipitation echo within the cloud was frequently in the form of a hollow, inverted cup that usually filled in and became completely reflecting in a few minutes.

Washington U., Seattle.
ARCTIC CIRCULATION STUDIES, by Richard J. Reed. Final rept. on Contract AF 19(604)3063. Sep 59, 61p. 35 refs. AFCRC-TR-59-284.
Order from LC mi$3.90, ph$10.80 PB 145 255

On the basis of a number of synoptic and synoptical-climatological studies we arrive at the following picture of the arctic circulation in summer. A secondary baroclinic zone, distinct from the polar front, develops along the northern shores of Siberia, Alaska and Canada in summer. Cyclones which originate in this zone, and to a lesser extent in the polar frontal zones to the south, frequently invade the central Arctic. The stagnation of these lows near the pole leads to a high frequency of occurrence of low pressure centers and a weak area of low pressure in the mean. There is no evidence for the often assumed semipermanent anticyclone near the pole. The disturbances of the polar region in summer are shown to be similar to typical middle latitude storm systems. The question of the representativeness of present results, which were based entirely on data for the five summers, 1952-1956, is considered, an and it is concluded that the characteristics of the circulation during these summers were not significantly different than during a number of years, dating back to 1894, for which expedition data were available.

Frost Science

National Research Labs., Ottawa (Canada).
ON THE TRANSFER OF HEAT FROM A RIVER TO AN ICE SHEET, by W. D. Baines. Oct 59, 19p. 5 refs. Mechanical engineering rept. MH-93.
Order from LC mi$2.40, ph$3.30 PB 145 538

Naval Research Lab., Washington, D. C.
THE ADHESION OF ICE TO LUBRICATED SURFACES, by H. R. Baker, W. D. Bascom, and C. R. Singleterry. Interim rept. 9 Feb 60, 17p. 13 refs. NRL rept. 5429.
Order from LC mi$2.40, ph$3.30 PB 143 939

The adhesion of ice to lubricated steel has been shown to vary over a wide range depending upon the polar organic additive present in the lubricating oil. The adhesion is least for systems showing contact angles of 170° or greater measured through water drops on steel submerged in the oil solutions. The extremely low adhesions observed in such systems arise because water does not readily displace the final thin film of bulk oil from the metal surface to establish true water/solid contact. High water contact angles are associated with strong adsorption of the polar additive at the oil/metal interface and with relatively low adsorption at the oil/water interface. The surface properties and viscosity of the oil itself may affect the rate at which oil displacement occurs and thereby alter ice adhesion under field conditions. Adhesion of ice to lubricated Teflon surfaces varies with contact angle in the same way as that on steel. This supports

the conclusion that effective additives adsorb on the steel to form a low energy surface. The contact angle phenomena observed bear also on emulsification behavior and the performance of water-filtration equipment for aircraft fuels. (Author)

Washington U., Seattle.
ON THE CRYSTAL FABRICS AND MORPHOLOGY OF ARCTIC SEA ICE, by Walter Schwarzacher. Preliminary rept. Technical rept. no. 1 on Drifting Station Alpha, Contract Nonr-477(23). [1959] 6p.
Order from LC mi$1.80, ph$1.80 PB 145 390

Direct observations show that every year sea-ice is formed by freezing on the underside of the floes from December to June whereas during summer melting removes some of the old ice from the surface of the floe.

Geodesy

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
HANDBOOK: A TECHNIQUE FOR PREPARING DESERT TERRAIN ANALOGS, by J. R. Van Lopik and C. R. Kolb. May 59, 184p. 23 refs. Technical rept. no. 3-506; AD-217 639.
Available for $3.00 from US Army Engineer Waterways Experiment Station, Vicksburg, Miss. When supply is exhausted, order from LC as PB 146 038, mi$8.40, ph$28.80

A technique is described whereby desert areas selected for terrain comparison are mapped in terms of general terrain factors, geometry factors, ground factors, and vegetation. Terrain-factor data are synthesized to establish varying degrees of analogy of particular desert areas with portions of any selected base area. This synthesis includes compilation of geometry, ground, and vegetation analog maps--through combination of their component terrain-factor maps. A composite analog map is prepared by superimposing geometry, ground, and vegetation analog maps and stratifying the resulting combinations. Highly analogous desert tracts exhibit, or closely approximate, combinations of terrain-factor mapping units found in the base area, and the degree of analogy decreases directly as the similarity to such combinations decreases. Small areas mapped at large scales can be compared with areally similar tracts or with larger regions mapped at smaller scales. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A GENERAL ANALYTICAL SOLUTION TO THE PROBLEM OF PHOTOGRAMMETRY, by Hellmut H. Schmid. July 59, 83p. 17 refs. Rept. no. 1065.
Order from LC mi$4.80, ph$13.80 PB 145 274

An analytical treatment of the general problem of photogrammetry is developed which only requires that object point, center of projection and corresponding image point are collinear for any one ray present in a specific photogrammetric measuring procedure. The corresponding formulas, expressing the geometrical relation existing between the spatial coordinates of the object, the plate coordinates of the corresponding image and the elements of orientation, are the bases for a rigorous least squares adjustment, whereby both the image-coordinates measured on a comparator, and the given control data may be considered as erroneous. The corresponding system of normal equations, which is shown to be typical for any photogrammetric measuring problem is used to form a system of reduced normal equations, the unknowns of which are either the elements of orientation or the spatial coordinates of the model. The application of matrix calculus not only simplifies the presentation but reduces the "bookkeeping effort", while establishing the corresponding program for electronic computers. A special chapter deals with the problem of incorporating additional geometric conditions as they may exist between any one or all of the unknowns of the solution.

Pennsylvania U., Philadelphia.
THE D-LINE METHOD, by Lester E. Klimm. Rept. for 1 Dec 56-1 Dec 57 on Contract Nonr-551(01). 1 Dec 57. 5p. Annex to Summary of Scientific Results, PB 138 077.
Order from LC mi$1.80, ph$1.80 PB 138 122

The object was to enclose within an objectively-determined boundary on a map all points of a dispersant lying D distance or less from one or more other points of the same dispersant. (See also PB 138 077)

Vision Research Labs., U. of Michigan, Ann Arbor.
THE CONSTRUCTION OF A MODEL TERRAIN SIMULATOR AT A SCALE OF 1:108, by Gilbert B. Lee. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 37p. 14 refs. Rept. no. 2144-342-T; AD-213 985.
Order from LC mi$3.00, ph$6.30 PB 145 374

Steps used in the construction of a terrain model, scale 1 inch equals 9 feet, are described and illustrated. Shop and equipment preparations and technical references used in the completion of a 20 x 20 foot indoor model are included to show the set-up that produced a model which is currently being used in studies of visual surveillance capabilities. A new method of forming the mapped contour detail to its original shape and size, with scale reduced, has been developed which should contribute to a more extensive use of three-dimensional terrain scale models in future visual surveillance research. (Author)

Geology

Air Force Cambridge Research Center, Bedford, Mass.
PROCEEDINGS OF THE ANNUAL ARCTIC PLANNING SESSION [NO. 2] OCTOBER 1959, by Vivian C. Bushnell. Dec 59, 180p. 27 refs. GRD Research Notes no. 29; AFCRC-TN-59-661.
Order from OTS $3.00 PB 161 521

Results of field investigations and laboratory studies associated with the Arctic Terrain Research Program of the Terrestrial Sciences Laboratory are given. The papers included are those presented at the Second Annual Arctic Planning Session sponsored by the Terrestrial Sciences Laboratory. Reports include research accomplished in the Arctic Ocean, studies of ice-free land, studies of the Ellesmere Ice Shelf, investigations of Arctic Lakes, research into the physical and engineering properties of ice, and related topics. (Author) (See also PB 151 839)

Lamont Geological Observatory, Palisades, N. Y.
THE LONG TERM RECORDER, by G. R. Hamilton and R. F. McAllister. Technical rept. no 5 on Contract Nonr-266(37). Jan 59, 26p. CU-59-2-Nonr-266(37).
Order from LC mi$2.70, ph$4.80 PB 145 589

A small battery operated microfilm recorder for geophysical signals with periods longer than one second is described. It is capable of operating for periods of a month or more without attention. Enlargements of typical records and construction blueprints are included. (Author)

Mineralogy

[Washington U., St. Louis, Mo.]
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGMATITE MINERALS, by A. F. Frederickson and Joseph E. Cox, Jr. Supplement to Final rept. for 15 Apr 51-15 Apr 53 on Contract DA 36-039-sc-5513. [1953] 6p.
Order from LC mi$1.80, ph$1.80 PB 138 193-S

Field and laboratory studies show that certain ions have through solid rocks. A tentative outline of the mechanism of transport and physical state of the moving ions is offered. (See also PB 138 193)

Washington U., St. Louis, Mo.
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGMATITE MINERALS, by A. F. Frederickson and Joseph E. Cox, Jr. Final rept. for 15 Apr 51-15 Apr 53 on Contract DA 36-039-sc-5513. [1953] 29p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 138 193

The object of this research is to obtain an insight into the mechanism of crystal growth, and to synthesize certain pegmatite minerals.

Washington U., St. Louis, Mo.
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGAMITE MINERALS, by A. F. Frederickson. Final rept. for 16 Apr 53-15 Apr 54 on Contract DA 36-039-sc-42650. [1954] 137p. 20 refs.
Order from LC mi$6.90, ph$21.30 PB 138 195

Composition and physical state of some of the components of the solutions from which certain mica and other crystals have grown in nature is described. In rocks from Kragerø Norway large mica (biotite) crystals grew in the presence of CO_2- and chlorine-rich waters while the rocks were in the solid state: the micas did not grow from a melt. A technique for growing or "filming" large sheets of a layer lattice or mica-like mineral has been developed. (See also PB 138 194)

[Washington U., St Louis, Mo.]
RESEARCH RELATED TO THE FORMATION AND GROWTH PEGMATITE MINERALS, by A. F. Frederickson, Joseph E. Cox, Jr. and Paul Yen-hsiung Feng. Quarterly progress rept. no. 2, 15 July-15 Oct 53, on Contract DA 36-039-sc-42650. [1953] 28p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 138 192

Anorthite has a lower "solubility" in pure water at elevated temperatures and pressures than either quartz or albite. Foreign constituents such as metal oxides or hydroxides have a marked depressing effect on anorthite "solubility". The "solubility" curves have a very interesting S-shape indicating that some new phase or state of aggregation must prevail between 250 and 325°C. Construction of a new electrodialysis apparatus is reported. (See also PB 138 193)

[Washington U., St. Louis, Mo.]
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGAMITE MINERALS, by A. F. Frederickson, Joseph E. Cox, Jr. and others. Quarterly progress rept. no. 3, 16 Oct 53-15 Jan 54 on Contract DA 36-039-sc-42650. [1954] 45p. 7 refs.
Order from LC mi$3.30, ph$7.80 PB 138 194

Optical data on a portion of the Kragerø (Norway) rocks which furnished sodium for some of the large pegmatites in the region. Silicate films can be made in a very short period of time; uniform in size, thickness, and semitransparent, on a continuous basis, in any thickness desired, as single sheets or laminated films. (See also PB 138 192)

Oceanography

Lamont Geological Observatory, Palisades, N. Y.
HYDROPHONE LOCATION, by Carl Hartdegen. Technical rept. no. 13 on Contract N6onr-27124. Feb 59, 47p. 10 refs. CU-23-59-N6onr 27124-Geol.
Order from LC mi$3.30, ph$7.80 PB 145 252

Two methods of locating a bottom hydrophone in deep water off Bermuda by underwater acoustic methods are described. The first method utilized an explosive ranging technique, the second method utilized a precision echo sounder to locate positions with equal travel times to the hydrophone. Hydrophone position accuracies obtained were 15-20 feet for a location in 456 fathoms (2736 feet) of water. This position ac-

curacy was limited by the accuracy with which the surface sound source could be located rather than by underwater acoustics. (Author)

Washington U., Seattle.
A MODIFICATION OF THE WENNER-SMITH-SOULE SALINITY BRIDGE FOR THE DETERMINATION OF SALINITY IN SEA WATER, by Robert G. Paquette. Supplement to Technical rept. no. 61 on Contract Nonr-477(10). Feb 59, 6p. 1 ref. Reference 59-2, Supplement no. 1.
Order from LC mi$1.80, ph$1.80 PB 145 590

Since Technical Report No. 61 (PB 140 874) was issued in August 1958, a number of improvements have been made in design of the salinity bridge. One significant abnormal behavior has been found occurring during cell filling, and a few errata have been found in the report; therefore, it seems desirable to issue this supplement which contains: 1. Errata, 2. Notes on design and behavior of the salinity bridge.

Physics of the Atmosphere

Air Force Cambridge Research Center, Bedford, Mass.
MEASUREMENTS OF FLUX OF SMALL EXTRA-TERRESTRIAL PARTICLES, by Herbert A. Cohen. Jan 60, 16p. 10 refs. GRD Research notes no. 28; AFCRC-TN-59-647.
Order from OTS $0.50 PB 161 520

Through use of wire grids and highly sensitive microphones, direct measurements of micrometeorite influx and their damaging effects have been made from satellites and rockets. These measurements indicate that 10^{-3} particles/(m^2 sec) is the order of magnitude of flux into the Earth's atmosphere of extraterrestrial particles several microns in size; they also indicate shower periods. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
INTERPRETATION OF A DYNAMICAL APPROXIMATION FOR ISOTROPIC TURBULENCE, by Robert H. Kraichnan. Rept. on Contract Nonr-285(33). Mar 59, 28p. 8 refs. Research Rept. no. HSN-1.
Order from LC mi$2.70, ph$4.80 PB 145 799

Recently parts of a theory of homogeneous turbulence which is based upon a new kind of perturbation method have been described. This method leads to closed statistical equations for the velocity covariance upon making a dynamical approximation which was termed the direct-interaction approximation. The present paper gives a brief review of this theory in which the basic equations will be interpreted dynamically, but not derived. In contrast to the previous treatments, which were devoted primarily to the stationary, isotropic case, this paper is concerned with freely decaying turbulence.

Ionosphere Research Lab., Pennsylvania State U., University Park.
THE FORMATION OF THE D REGION OF THE IONOSPHERE, by M. Nicolet and A. C. Aikin. Scientific rept. no. 125 on Ionospheric Research, Contract AF 19(604)4563 and National Science Foundation Grant G-5939. 1 Nov 59, 43p. 47 refs. AFCRC-TN-60-213.
Order from LC mi$3.30, ph$7.80 PB 145 623

Radiations of solar origin penetrating below 85 km in the terrestrial atmosphere are: (1) X-rays of $\lambda < 10$ Å; (2) Lyman-alpha and (3) Wave lengths greater than 1800 Å. These radiations can ionize: (1) molecular nitrogen and oxygen; (2) nitric oxide and (3) metallic ions such as sodium and calcium. Molecular oxygen and nitrogen are also ionized by cosmic rays. The negative ion to electron ratio is important below 70 km and affects the electron distribution below that altitude. Normal ionization conditions are explained by cosmic rays and Lyman-alpha. Solar flare conditions are explained by X-rays. Above 85 km, the behavior of the ionization is related to the E layer. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
VERTICAL TRANSPORT OF ELECTRONS IN THE F REGION, by Sushil Chandra, J. J. Gibbons, and E. R. Schmerling. Scientific rept. no. 124 on Ionospheric Research, Contract AF 19(604)3875. 1 Oct 59, 47p. 18 refs. AFCRC-TN-59-659.
Order from LC mi$3.30, ph$7.80 PB 145 292

The continuity equation of electron density is solved to yield an expression for the vertical transport which can be evaluated from electron-density-true-height profiles. A few numerical computations are presented of the vertical drift-velocities determined for the four I. G. Y. stations - Huancayo, Talara, Panama and Washington. It is shown that the velocity is predominantly downwards during the night and upwards during the day at the equatorial stations. There is an apparent phase reversal from summer to winter at Washington.

National Bureau of Standards, Boulder, Colo.
MEAN ELECTRON DENSITY VARIATIONS OF THE QUIET IONOSPHERE. 2. APRIL 1959, by J. W. Wright and L. A. Fine. Feb 60, 53p. 5 refs. Technical note no. 40-2.
Order from OTS $1.25 PB 151 399-2

The results of this program for one month are illustrated graphically. (See also PB 151 399-1)

National Bureau of Standards, Boulder, Colo.
TABLES FOR THE STATISTICAL PREDICTION OF RADIO RAY BENDING AND ELEVATION ANGLE ERROR USING SURFACE VALUES OF THE REFRACTIVE INDEX, by B. R. Bean, B. A. Cahoon, and G. D. Thayer. 16 Mar 60, 22p. 3 refs. Technical note no. 44.
Order from OTS $0.50 PB 151 403

Radio ray bending, γ, and elevation angle error, ε, have been calculated for a wide range of meteorological conditions at 13 climatically diverse U. S. radiosonde stations. The parameters in the observed linear regression equations of γ and ε upon the surface value of the refractive index are given for heights of 0.1 to 70 kilometers and initial elevation angles of the ray from 0 to 900 milliradians. (Author)

Navy Electronics Lab., San Diego, Calif.
A PROPOSED METHOD FOR INVESTIGATING THE RELATION BETWEEN THE D AND E LAYER HEIGHTS AND STRATOSPHERIC CIRCULATION, by V. R. Noonkester. 16 May 58, 28p. 6 refs. Research rept. 842; AD-212 871.
Order from LC mi$2.70, ph$4.80 PB 145 352

Two statistical methods developed in the field of meteorology were studied and shown to provide means for determining the relation between stratospheric circulation and the height of the D and E layers of the ionosphere. (Author)

ENGINEERING

Aeronautical Engineering

Air Proving Ground Center, Elgin AFB, Fla.
A HUMAN FACTORS STUDY OF THE INTEGRATED VISUAL APPROACH AND LANDING AIDS (IVALA) SYSTEM, by Harold J. Coleman. Dec 59, 100p. 24 refs. APGC-TR-59-52.
Order from LC mi$5.40, ph$15.30 PB 145 136

It was determined that the visual approach and landing aids system provided the visual references necessary for aircraft recovery under all visibility conditions down to reported zero. Using ground-controlled approach as the primary approach facility and Configuration "A" Approach Lighting System, with strobes, for early system identification and alignment, aircraft were brought safely down to a range of 1/4 mile. At this point, pilots were able to establish visual contact with the Narrow Gauge flush-mounted runway lighting which provided the height, roll, pitch, and directional guidance necessary for pilots to complete landings under visibility conditions down to a reported zero. Centerline run-out lights provided the necessary directional guidance for pilots to safely complete high-speed run-outs following landing. Transverse Roll Guidance Bars were found to be an undesirable and unnecessary component of the approach lighting complex.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON MODELS FOR THE PROBABILITY OF FATIGUE FAILURE OF A STRUCTURE, by Emanuel Parzen. Technical rept. no. 45 on Contract N6onr-251(40). 17 Apr 59, 32p. 21 refs.
Order from LC mi$3.00, ph$6.30 PB 145 396

Use of the probability theory to survey some of the problems involved in evaluating structural safety; a review of the probabilistic considerations involved in evaluating the strength of materials, and the construction of so called S-N curves.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STANDARD DESIGNATIONS OF ALLOYS FOR AIRCRAFT AND MISSILES: TRADE NAMES, AERONAUTICAL AND MILITARY SPECIFICATIONS AND PRODUCERS OF STAINLESS STEELS, ALLOY STEELS AND SUPERALLOYS, by J. J. Vagi. 25 Jan 60, 65p. DMIC memo. 42.
Order from OTS $0.50 PB 161 192

Fairchild Aricraft Div., Hagerstown, Md.
POWER REQUIREMENT OF A BLOWING WING WITH SEALED AND SLOTTED TRAILING EDGE FLAPS: MODEL M-246A, by H. B. Helmbold. Rept. on Contract Nonr-2226(00). 13 Mar 59, 28p. 4 refs. Engineering rept. no. R246A-004.
Order from LC mi$2.70, ph$4.80 PB 145 594

Wind-tunnel tests on a blowing NACA 23015 airfoil with a 25% chord slotted flap and with blowing-slot widths of 0.9 and 0.15% chord, at flap-deflection angles from 30° to 70°, have been analysed in Ref. 1. These tests were recently supplemented by extending the range of flap-deflection angles to 0° and by investigating the same model with a sealed flap and with an effective blowing-slot width of 0.7% chord, over the whole range of flap-deflection angles from 0° to 70° (Refs. 2 and 3). The new set of experiments is analysed in the present report. The analysis was restricted to states of flow where the flow was fully attached to the flap.

Goodyear Tire and Rubber Co., Akron, Ohio.
IMPROVED SEAT AND BACK CUSHIONS, by R. K. Whittenberger. Rept. on Aircraft Fatigue on Extended Missions, Contract AF 33(600)27477. Nov 59, 30p. 7 refs. WADC Technical rept. 59-376.
Order from OTS $0.75 PB 161 486

Development of an improved pilot seat and back assembly for the reduction of pilot fatigue is described in detail. The design criteria for these seat and back cushions are included. The study covers both seat design and seating materials; 25 experimental pilot seat cushions and 25 experimental back cushions were produced both contoured and noncontoured, as well as foam rubber and polyurethane foam. The results of this study indicate that polyurethane foams of a proper density and compression resistance can be safely and efficiently used in aircraft pilot seat and back cushions. The combined advantages of lighter weight, solvent resistance, and closer quality control indicate that the polyurethane foams offer a superior body support material. (Author)

Institute of Engineering Research, U. of California, Berkeley.
THE OXYGEN RECOMBINATION PROGRAM, by S. Hoenig. Preliminary rept. no. 1, 15 Oct-30 Dec 57, on Contract Nonr-222(45). 22 Jan 58, 17p. 9 refs. Technical rept. no. HE-150-155; Series no. 20, issue no. 118; AD-162 606.
Order from LC mi$2.40, ph$3.30 PB 137 919

An electrodeless discharge apparatus and the associated gas handling equipment have been constructed for experiments involving oxygen recombination has been developed with particular emphasis on the separation of frictional heat transfer from the true heat input due to recombination. Experiments using the Low Pressure Supersonic Wind Tunnel indicate that at present few if any oxygen atoms survive to enter the test section. (Author)

Marquardt Corp., Van Nuys, Calif.
SHORT TIME, ELEVATED TEMPERATURE, STRESS-STRAIN BEHAVIOR OF TENSILE, COMPRESSIVE AND COLUMN MEMBERS, by Eugene C. Bernett. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)6043. Dec 59, 144p. 12 refs. WADC Technical rept. 59-484.
Order from OTS $2.75 PB 161 492

The short time tension and compression properties of four aircraft sheet materials were evaluated at room and elevated temperatures at strain rates ranging from 0.00001 to 0.1 in./in./sec. Short time compression creep properties were also evaluated and methods are shown how these data can be used to define the behavior of columns at high temperatures. The strain rate has a pronounced effect on the measured tensile strengths. It is shown that creep rates are very rapid at high stress and high temperatures - excessive amounts of deformation can occur in times of the order of one second or less. (Author)

National Research Labs., Ottawa (Canada).
COMPARISON OF SOME EXPERIMENTAL AND THEORETICAL DATA ON DAMPING-IN-ROLL OF A DELTA-WING BODY CONFIGURATION AT SUPERSONIC SPEEDS, by L. T. Conlin and K. J. Orlik-Rückemann. Dec 59, 21p. 3 refs. Aeronautical rept. LR-266.
Order from LC mi$2.70, ph$4.80 PB 145 537

National Research Labs., Ottawa (Canada).
POWERPLANTS FOR VTOL AIRCRAFT: A PROPOSED DUAL-OPERATION SYSTEM USING WING-IMMERSED FANS FOR VERTICAL THRUST, by E. P. Cockshutt and N. Galitzine. Oct 59, 93p. 3 refs. Aeronautical rept. LR-265.
Order from LC mi$5.40, ph$15.30 PB 145 535

National Research Labs., Ottawa (Canada).
A PROBABILITY ANALYSIS OF COINCIDENT GUST AND MANOEUVRE LOADS IN LOW-FLYING AIRCRAFT, by S. D. Baxter, J. Liiva, and R. T. Sewell. 17 Nov 59, 40p. 4 refs. Aeronautical rept. LR-264.
Order from LC mi$3.00, ph$6.30 PB 145 539

Naval Air Test Center, Patuxent River, Md.
A SIMPLE GROSS THRUST METER AND SOME OF ITS APPLICATIONS AT THE NAVAL AIR TEST CENTER, by W. J. Hesse. 24 Mar 54, 72p. 10 refs. Test Pilot Training Div. Technical rept. no. 1-54.
Order from LC mi$4.50, ph$12.30 PB 145 922

A simple gross thrust meter developed by the author in 1951 and in use since that time at the Naval Air Test Center (NATC) is discussed with regard to theory of operation, calibration procedures, and some of its applications to flight test work. It is shown that a thrust indicator is becoming more necessary to properly monitor modern turbojet engine power and that the thrust meter described herein will indicate thrust reliably and accurately. A discussion of the relative importance of gross and net thrust to aircraft operating activities is also presented.

New York U., N. Y.
INVESTIGATION OF CREEP BUCKLING OF COLUMNS AND PLATES. PART I. ELEVATED TEMPERATURE PROPERTIES OF THE TEST MATERIAL Ti-7Al-4Mo TITANIUM ALLOY, by Ralph Papirno and George Gerard. Rept. for June 58-May 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5807. Nov 59, 34p. 3 refs. WADC Technical rept. 59-416, Pt. 1.
Order from OTS $1.00 PB 161 488

As a first phase of an investigation of the creep buckling of columns and plates, materials properties tests were conducted on Ti-7Al-4Mo Titanium Alloy in both the annealed and heat treated conditions. Heat treatment to obtain optimum creep performance was 1450°F-1 hr, FC to 1050°F, AC; 1050°F-24 hr, AC. A new technique for the collection of compression creep data from sheet specimens was developed in which both the short time stress-strain properties prior to creep and the creep data itself are autographically recorded. Short time tests were conducted at room temperature, 750°F, 850°F and 950°F. Compressive creep data were collected at 850°F and 950°F. (Author)

Norair Div., Northrop Corp. [Hawthorne, Calif.]
DECOMPRESSION OF A PUNCTURED PRESSURIZED CABIN, by Serge T. Demetriades. 1 Sep 59, 35p. 10 refs. Rept. no. NB 59-224.
Order from LC mi$3.00, ph$6.30 PB 145 247

Expressions are developed for the flow velocity, density and pressure, at any point in a cabin which is suddenly punctured, until the instant the reflected

rarefaction wave reaches that point. These expressions apply to holes of any size and for ambient pressures of any magnitude. Methods are presented for calculating the forces on bodies in the cabin and on the body of the vehicle due to the flow of gas out of the cabin and for estimating the time necessary for decompression to any lower pressure. These forces may be large compared to all other dynamic and propulsion loads.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
DEVELOPMENT OF CARTRIDGE ACTUATED DEVICE, EJECTOR, T7, by W. Beaz. Aug 58, 34p. 2 refs. Memo rept. no. MR-692; AD-204 520.
Order from LC mi$3.00, ph$6.30 PB 138 272

This report documents the design and development of the T7 drag chute ejector and includes a summary of the T15 delay element development including the Picatinny Arsenal T15 reports in Appendices B and C.

Wichita U., Kansas.
SHROUDED PROPELLER INVESTIGATIONS: AERODYNAMIC CHARACTERISTICS OF A SHROUD WITH CENTERBODY, by Vernon O. Hoehne. Rept. on Contract Nonr-201(01). Feb 59, 47p. 5 refs. Engineering rept. no. 337.
Order from LC mi$3.30, ph$7.80 PB 145 123

The shroud and centerbody components of two shrouded propeller models have been tested in the Walter H. Beech Memorial Wind Tunnel to determine the lift, drag and pitching moment characteristics of a shroud with centerbody. Results are shown as conventional aerodynamic coefficients defined in the same manner as results of earlier tests performed by NACA to permit a limited comparison. Results show that diffusing the after portion of the shroud increases the lift curve slope and maximum lift coefficient, reduces the angle of attack for stall, and moves the center of pressure forward. Increasing the centerbody or hub size relative to the shroud diameter has little effect on the lift characteristics of the unit, but increases the minimum drag coefficient with a non-diffused shroud. The combined effect of hub size and diffusion, however, cause minimum drag to decrease with an increase in hub size. Additional data applying to less prominent geometric variables are also shown in the data. (Author)

Chemical Engineering

American Potash and Chemical Corp., Henderson, Nev.
INDUSTRIAL PREPAREDNESS STUDY ON SYNTHETIC BATTERY GRADE MANGANESE DIOXIDE, by Jerome T. Muench. Quarterly progress rept. no. 7, 29 Dec 57-29 Mar 58, on Contract DA 36-039-sc-72719. [1958] 19p. 3 refs. AD-162 574.
Order from LC mi$2.40, ph$3.30 PB 137 946

Considerable progress was made on the construction of the one ton a day chemical manganese dioxide pilot plant, during this quarter. Painting, insulating and the acquisition and installation of apparatus, the only remaining activities, will require about one month for completion, after the approval of additional funds. Comparative performance tests were made on batteries, fabricated from acid digested and untreated chemical manganese dioxide, after storage for twelve months. From these and previous tests, it is seen that acid digestion results in a considerable improvement in initial high drain and delayed high and low drain capacities. An evaluation was begun on the effect of varying the amount of wetting solution used in chemical manganese dioxide batteries. A maximum amount, consistent with good bobbin strength, improved high drain capacities; while use of a minimum amount of solution seriously reduced low drain capacities. The battery test panels of the Signal Equipment Support Agency, Signal Engineering Laboratory and American Potash and Chemical Corporation were checked and found comparable. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE AEROSOL AND SPRAY FALL-OUT METER, by Robert D. Kracke and Albert Pfeiffer. Oct 59, 29p. 4 refs. CWLR-2317.
Order from LC mi$2.70, ph$4.80 PB 145 632

This report describes the fall-out meter, an instrument used in the evaluation of deposits from aerosol and spray clouds. It consists of a motor-driven rotating or transversely moving platform which carries slides beneath a slit in a cover plate. The fall-out meter relates, in time, deposition of particle concentration in the aerosol or spray cloud above the slit. Simultaneously, it produces a space dilution of the deposited particles. Examples are given of how the fall-out meter may be used to measure horizontal downwind velocity and lateral and vertical expansion rates of aerosol and spray clouds in the field and their particle-size distributions as produced in dissemination chambers. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PHOTOGRAPHIC TECHNIQUE FOR THE DETERMINATION OF SIZES OF LIQUID DROPLETS, by Alfred L. Woolridge. Rept. for May-Aug 58. 24 Feb 59, 10p. CWL Special Pub. 3-6
Order from LC mi$1.80, ph$1.80 PB 145 636

Droplet size samples of certain aerosols are collected on microscope slides coated with a red-dyed plastic film. Droplets of low volatile liquid produce spots which remain wet and continually spread. However, there is an optimum time at which these drops can be measured to obtain the relationship of spot diameter to drop diameter. Where large numbers of samples are involved, measuring the spots within a prescribed period of time becomes a near impossibility. A satisfactory technique has been developed for the rapid photography of field samples for drop size distribution.

Mine Safety Appliances Co., Callery, Pa.
LIQUID METAL TECHNOLOGY, by R. C. Werner. Final rept. for May 49-May 54 on Contract N9onr-85801. 29 Mar 55, 78p. 4 refs. AD-84 713.
Order from LC mi$4.50, ph$12.30 PB 137 517

A review of research on fluid flow, heat transfer, chloride corrosion, mass transfer, wetting of surfaces, instrumentation, pumps, valves, cold traps, thermal shock, welding, leak detection, water reactions, fire fighting, cleaning, accessibility, radioactive leaks, plugging, and life testing in the use of liquid sodium, potassium and their eutectic alloy (NaK).

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D. C.
CARBON DIOXIDE ABSORBENT EVALUATION AND CANISTER DESIGN, by H. W. S. Huseby and E. J. Michielsen. 6 Nov 59, 91p. 6 refs. Research rept. 1-60.
Order from LC mi$5.40, ph$15.30 PB 145 148

A laboratory test apparatus for the evaluation of carbon dioxide absorbents and absorbent canisters was designed including the canisters for the evaluation of absorbents. Future modifications of the apparatus were suggested and will be instituted in the present equipment at the Experimental Diving Unit. Maximum carbon dioxide productions for one and three hour swimming periods were determined with swimming tests in the pressure tanks at the Experimental Diving Unit. Tolerable carbon dioxide concentrations in the breathing media were determined and found to be in the range of 0.5 to 1.0 percent. The report also shows the effect of reducing the absorbent in a canister on the uptake of carbon dioxide. The preliminary evaluation of the double tube canister and the estimation of the volume of pellet Beralyme required for 3 hours operational duration are included.

[Office of Saline Water] Dept. of the Interior, Washington, D. C.
SALINE WATER CONVERSION. Annual rept. no. 3, 1954, of the Secretary of the Interior. Jan 55, 133p.
Order from OTS $2.75 PB 161 510

This report summarizes coordination activities and research and development in: electric membrane processes, vapor compression distillation, solar distillation, critical pressure devices, osmotic processes, solvent extraction, separation by freezing, ultrasonics, and general studies.

Office of Saline Water, Dept. of the Interior, Washington, D. C.
SALINE WATER CONVERSION. Annual Rept. of the Secretary of the Interior for 1955. Jan 56, 91p.
Order from OTS $2.25 PB 161 511

See also PB 161 510

Army Engineer Research and Development Labs., Fort Belvoir, Va.
HEATER, SPACE, MULTIFUEL-BURNING, ELECTRIC-MOTOR-DRIVEN, 90,000 BTU/HR, by H. R. Lopez. 29 Dec 59, 51p. Rept. 1598-TR.
Order from LC mi$3.60, ph$9.30 PB 145 661

Development and testing of a 90,000 Btu/hour, multifuel, electric-motor-driven, space heater for use in heating the Complete Assembly Structure (CAS building) which was procured by all branches of the Armed Forces. The tests described are for climatic suitability of the heater under actual arctic conditions, engineering tests, endurance tests, and service tests.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
WELDED-PIPELINE CONSTRUCTION TOOL SETS, by William S. Geurrant. 23 Sep 59, 73p. Rept. 1594-TR.
Order from LC mi$4.50, ph$12.30 PB 145 662

Testing and evaluation of several proposed welded petroleum-pipeline construction tool sets and their components intended for use by troops engaged in the construction of 4-, 6-, 8-, 12-, or 16-inch welded petroleum pipelines.

Bureau of Yards and Docks, Washington, D. C.
CIVIL WORKS CONTRACT ADMINISTRATION. Rev. 1 June 54, 21p. 4 refs. Technical pub. NAVDOCKS TP-Ad-2.
Order from LC mi$2.70, ph$4.80 PB 139 134

This publication outlines duties and responsibilities in the administration of civil works contracts. Major policies and procedures are described in relation to the design and construction of public works and utilities at privately operated establishments. These facilities, because they are Government financed, are designated as civil works. The policies, procedures, and responsibilities, although designed primarily for application to industrial facilities, also pertain to all other types of civil works in which the Department of the Navy has an interest.

Bureau of Yards and Docks, Washington, D. C.
HOUSING FORMULAS. Engineered Performance Standards, Public Works Maintenance. July 59, 110p. NAVDOCKS P-705.1.
Order from LC mi$5.70, ph$16.80 PB 145 004

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Bureau of Yards and Docks, Washington, D. C.
INSPECTION OF CONSTRUCTION CONTRACTS. 15 Apr 54, 447p. 84 refs. Technical pub. NAVDOCKS TP-Ad-5, BUDOCKS INST 4335.1 and CH1.
Order from LC mi$11.10, ph$68.10 PB 139 137

This publication, provides administrative and technical information for the guidance of inspectors of construction contracts under the administration of this Bureau and of other personnel concerned with the administration of such construction contracts. It is designed to enable newly assigned personnel to familiarize themselves rapidly with the Bureau's requirements and methods and to assure uniformity in practices and procedures.

Bureau of Yards and Docks, Washington, D. C.
PHYSICAL SECURITY OF PUBLIC WORKS. 18 July 56, 72p. 8 refs. Technical pub. NAVDOCKS TP-PL-9; BUDOCKSINST 5540.1 and Sup 1.
Order from LC mi$4.50, ph$12.30 PB 139 136

Presented herein are the technical criteria used in the design, planning, construction, and maintenance of public works and public utilities to prevent or minimize the effects of possible covert attack. Specifically, this includes physical security measures developed for protection against sabotage, employing such factors and facilities as education of employees, facility layout, alarm protection, protective lighting, fencing, and damage control in the event of an act of sabotage.

Bureau of Yards and Docks, Washington, D. C.
ROADS, GROUNDS, PEST CONTROL FORMULAS. Engineered Performance Standards, Public Works Maintenance. June 59, supersedes July 57. 196p. NAVDOCKS P-712.1.
Order from LC mi$8.70, ph$30.30 PB 145 007

Contents:
Roach control, in vacated housing
Rodent control, general
Lawn mowing
Sod cutting and laying
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Mowing: fields and parks
Trim hedges and shrubs
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Vegetative planting of Buffalo grass
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Debris clearing
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Bureau of Yards and Docks, Washington, D. C.
ROADS, GROUNDS, PEST CONTROL HANDBOOK. Engineered Performance Standards, Public Works Maintenance. June 59, 382p. NAVDOCKS P-712.
Order from LC mi$11.10, ph$59.10 PB 145 008

Contents:
Section I - Spread Sheets
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Electrical and Electronic Engineering

Advanced Semiconductor Lab., General Electric Co., Syracuse, N. Y.
ACTIVE DIODES OF THE PNPN TYPE. Final rept. for 1 June 58-31 Aug 59 on Contract AF 19(604)3910. 30 Sep 59, 64p. 26 refs. AFCRC-TR-59-359.
Order from LC mi$3.90, ph$10.80 PB 145 533

The bulk of this work is experimental in nature and in large part is concerned with a number of silicon switching devices which make use of "shorted-emitters." A number of types of shorted-emitter switches are described in detail in an appendix. In addition, experimental results are presented on various diffusion schemes used to make the switches of this work. Also, the results of doping with gold to reduce lifetime and increase speed are described and compared with the speed properties of various non gold-doped structures. (Author)

Aeronautical Radio, Inc., Washington, D. C.
INVESTIGATION OF ELECTRONIC EQUIPMENT RELIABILITY. Progress rept. no. 1 on Air Force Reliability Assurance Program. Contract NObsr-64508. 15 Feb 56, 107p. 8 refs.
Order from LC mi$5.70, ph$16.80 PB 145 919

The purpose of this report is to outline the basic program required in the development of prediction techniques, to aid in the standardization of terminology, and to provide a tentative prediction technique for verification experiments on existing systems and for application to new systems now in the system-planning stage. A report prepared so early in the course of a program of this magnitude must necessarily be somewhat speculative in nature. This report describes the frame of reference within which the investigation is being undertaken.

Air Force Cambridge Research Center, Bedford, Mass.
A CONCENTRIC LOOP ARRAY, by Allen C. Schell and Edmund L. Bouche. Apr 59, 28p. 4 refs. AFCRC-TR-59-129; AD-213 840.
Order from LC mi$2.70, ph$4.80 PB 145 302

A newly developed circularly symmetric array shows promise for general pattern synthesis and for electrical scanning. The basic elements of the array are thin-wire concentric circular loops. A loop of circumference $n\lambda$, n being an integer, carries a current standing wave that varies as $\cos n\phi$, where ϕ is the angle of rotation about the axis of the loop. The radiation field in the plane of the loop has a ϕ dependence identical with that of the loop current. By properly exciting a pair of feeds on each of a number of loops it is possible to produce a desired radiation pattern or rotate a beam in the ϕ coordinate. Off-axis radiation can be utilized or minimized, depending upon the application. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
TACTICAL AIR CONTROL SYSTEM, AN/TSQ-13(XD-1) RESEARCH AND DEVELOPMENT TEST 15 APRIL TO 15 DECEMBER 1956, by C. M. Jones, W. L. Arbuckle and others. Jan 58, 149p. 25 refs. AFCRC-TR-58-101(I); AD-146 795.
Order from LC mi$7.20, ph$22.80 PB 145 303

A research and development test of the Tactical Air Control System AN/TSQ-13(XD-1) was conducted. This report evaluates the performance of the electronic equipment used for this test and recommends modifications that will improve the Tactical Air Control System and the present equipments. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
A STUDY OF THE ACCURACY OF THE XN-1 RADAR, by Ned W. Hill, Jr. Rept. on Missile Test Project, Contract AF 08(606)3413. 24 Nov 59, 47p. RCA Data Processing Technical rept. no. 55; AFMTC-TR-59-28.
Order from LC mi$3.30, ph$7.80 PB 145 478

The results of XN-1 accuracy studies under Operational Directive No. 039 are presented and some of the system errors are discussed. (Author)

Andersen Labs., Inc., West Hartford, Conn.
RADIO INTERFERENCE FILTER F-312 (XW-1)/G. Final development rept. for 15 Feb 56-15 Feb 57 on Contract AF 30(635)2908. [1957] 22p. RADC-TR-57-187; AD-131 371.
Order from LC mi$2.70, ph$4.80 PB 145 439

This report presents a description of radio interference filter F-312 (XW-1)/G as delivered on contract AF30(635)2908. The filter is a development model of a capacitor storage signal integrator designed in accordance with exhibit RADC - 1777 for use in direction finding equipment. The unit, designed as a replacement for other more cumbersome equipment, is an effective means of improving the signal-to-noise ratio to the point where a usable output is obtained when the input signal to-noise ratio is 0.066. Certain recommendations are made for further improvement and reduction in the input power requirements. (Author)

Andersen Labs., Inc., West Hartford, Conn.
ULTRASONIC PROPAGATION IN SOLID MATERIALS. Final rept. for 1 July 55-30 Oct 58 on Contract AF 19(604)1423. [1958] 30p. 1 ref. AFCRC-TR-58-188; AD-160 851.
Order from LC mi$2.70, ph$4.80 PB 137 988

A. Investigation of the properties of quartz delay lines and methods of measurement of delay line parameters
B. Development of a variable, wide band, low noise, ultrasonic delay line and associated drive circuitry
C. Development of a radar AM video sweep integrator and system trigger pulse generator

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32( ) by Andrzej B. Przedpelski. Quarterly progress rept. (Engineering) no. 2, Oct 54-15 Jan 55, on Contract DA 36-039-sc-64450. 18 Jan 55, 50p.
Order from LC mi$3.30, ph$7.80 PB 145 338

The change of transistor characteristics with temperature, voltage and current was studied rather extensively to determine its effect on the performance of the individual circuits. A regulated, dual, low voltage, metered, power supply was built to facilitate the testing of the numerous transistors. A tester to determine the value of β was built. This tester plugs directly into the test power supply. A breadboard of the audio amplifier to be used in the final equipment was built and preliminary tests on it were conducted. No particular difficulty was encountered, although problems are expected in the Band C (25 MC to 50 MC) VFO, amplifier and mixer. (Author)
(See also PB 145 336)

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32 ( ) by Andrzej B. Przedpelski. Quarterly progress rept. (Engineering) no. 3, 15 Jan-15 Apr 55, on Contract DA 36-039-sc-64450. 30 Apr 55, 24p.
Order from LC mi$2.70, ph$4.80 PB 145 337

Construction of the final experimental model was started. Various circuit configurations were tried in a breadboard form to establish their effect on transistor temperature stability. The trends were noted and the final circuits will make use of this information. A 25-50 MC VFO breadboard was built using the Germanium Products tetrode RDX-300. Original Philco SBT types looked promising, but the latest types have lower maximum frequency of oscillation and are not satisfactory. A 25-50 MC buffer stage breadboard was built using the RCA 2N33 point contact transistor. At the present time this is the only type giving adequate drive to the mixer and satisfactory isolation. Some difficulties were encountered with Band C (25-50 MC) VFO, buffer and mixer and the VFO stability is still unknown. There seems to be little choice both in transistors which can be used and in circuit configurations, the main prob-

lem being the difficulties encountered at the higher frequencies which impose rigidly transistor type and the circuit peculiar to the best utilisation of this type. (Author) See also PB 145 388)

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32( ) by Andrzej B. Przedpelski. Final rept. (Engineering) for 15 Apr-1 Aug 55 on Contract DA 36-039-sc-64450. 1 Aug 55, 40p.
Order from LC mi$3.00, ph$6.30 PB 145 339

A final unit was built. No encapsulation was used to permit change of components. None of the critical components, including transistors, were selected. This policy was established and followed, since, in our opinion, equipment thus built is more representative of a reproducible unit. Final tests were conducted to determine whether the ultimate goal of successfully transistorizing the AN/URM-32( ) Frequency Meter was met. The main scope of the work at this stage consisted mainly of combining all the separately tested circuits (during Phases I and II) into one unit performing all the necessary functions. Some signal levels had to be readjusted to arrive at the best compromise without unnecessarily complicated circuits. No major difficulties were encountered. (Author) (See also PB 145 337)

Arinc Research Corp., Washington, D. C.
IMPROVED TECHNIQUES FOR DESIGN-STAGE RELIABILITY PREDICTION, by H. B. Brown, W. C. Fredrick and H. J. Kennedy. Progress rept. no. 2, v. 1, on Air Force Reliability Assurance Program, Contract AF 33(600)38438. 1 Apr 59, 88p. 7 refs. Publication no. 110-1-136.
Order from LC mi$4.80, ph$13.80 PB 145 918

Comparison of the measured and predicted reliability of the system revealed that the predicted mean time-between-complaints was 1.9 times as great as the observed value. This result is considered encouraging, and indicates that the basic technique is sound. However, analysis of the observed data suggested that a number of modifications in the technique would enable additional characteristics to be predicted and would increase the accuracy of predictions made in the future. In addition, other changes were found to be desirable in order to facilitate the application and evaluation of the technique.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
THE DEVELOPMENT AND ENGINEERING TESTS OF A TRANSISTORIZED HIGH-VOLTAGE POWER SUPPLY FOR INFRARED BINOCULARS, by Isadore Kessler. Summary rept. 25 Sep 59, 23p. Technical rept. 1597-TR; AD-229 029.
Order from LC mi$2.70, ph$4.80 PB 145 276

The report summarizes the development and engineering tests of a 12-kv, d-c power supply for use as the source of high voltage for operating two Type 6929 infrared image tubes in Corps of Engineers infrared binoculars. Tests were conducted to determine: (a) Effect of change of input voltage on output voltage and input current; (b) effect of change in output load current on input current and output voltage; (c) effect on electrical characteristics with continuous operation from one dry battery, size "C" cell; (d) percentage of ripple; (e) effect of operation under extreme temperatures; and (f) audible noise level.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
ENGINEERING EVALUATION REPORT OF THE 100-KW, PRECISE POWER, DIESEL-ENGINE-DRIVEN GENERATOR SET, MODEL 6910, by T. David Cooper, George F. Sams, and Norman B. Dill. 10 Sep 59, 60p. Technical rept. 1593-TR.
Order from LC mi$3.60, ph$9.30 PB 145 361

This two-part technical report covers the engineering tests and evaluation of the 100-kw, precise power, diesel-engine-driven engine-generator sets, Model 6910. The generator sets as originally designed were satisfactory and they met development requirements except (a) overload protection; (b) voltage dip on low power factor load; (c) speed recovery time for application of rated load; and (d) altenator temperature rise. The generator set with governor, generator armature, age regulator, and exciter modified will meet all of the existing requirements for precise power generator sets except those regarding overload protection. Part II concludes that all future generator sets of the type covered by this report should incorporate changes, as outlined herein, to obtain optimum design of exciters and voltage regulators. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
JUNCTION TRANSISTOR MEASUREMENTS AND PRACTICAL STANDARDS, by Bernard Reich. 16 Feb 59, 24p. 5 refs. USASRDL Technical rept. 2014.
Order from OTS $0.75 PB 161 469

An attempt has been made to set forth measurements and circuits required for the specification and evaluation of junction transistors. The report covers the basic measurements required on most transistors, and specific techniques and circuits for VHF and UHF devices. Finally, a sample outline of a portion of a transistor specification is given to demonstrate the acceptance electrical tests. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
LEAKAGE OF ELECTROMAGNETIC ENERGY FROM COAXIAL CABLE STRUCTURES, by K. Ikrath. 1 Apr 58, 51p. 11 refs. USASRDL Technical rept. 1964; AD-201 199.
Order from LC mi$3.60, ph$9.30 PB 145 660

A better understanding of the behaviour of electromagnetic leakage fields emanating from braid shielded coaxial cables is obtained. It is shown that a braid surface EMF per unit length which is linked to the magnetic leakage-flux distribution in the braid apertures tends to support a slowly propagating surface

wave along the cable. At higher frequencies end effects play an important role in the shaping of the leakage radiation fields which acquire the typical tilted multilobe patterns of slow wave radiators. Measures regarding the suppression of leakage through cable braids employing concentration and hysteresis type dissipation of leakage energy in ferrite coatings is suggested. The initiation of an investigation of the practicality of utilizing the phenomena associated with leaky braid shielded cables for the design of slow-wave radiators and surface wave launchers is recommended. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
RADIO TRANSMITTING SET AN/PRN-2, by R. A. Johnson. 1 May 58, 71p. USASRDL Technical rept. 1961.
Order from LC mi$4.50, ph$12.30 PB 145 275

This report includes a discussion of problems which arose during the development of Radio Transmitting Set AN/PRN-2 and Radio Receiving Set AN/PRN-3, together with the results of the engineering tests associated with Radio Transmitting Set AN/PRN-2. These equipments were developed to fulfill a need for marking and locating air-delivered equipment as indicated by the Military Characteristics for Site Marking and Locating Devices. Certain features of Radio Receiving Set AN/PRN-3 and Radio Transmitting Set AN/PRN-2 are at variance with applicable specifications and the Military Characteristics. Of these, some can be reconciled, others must be accepted as they are. Specifications for both the site marker and the site locator have been revised to indicate required modifications. A new contract was placed for additional models of Radio Receiving Set AN/PRN-3 incorporating recommended modifications. Photographs of the equipment resulting from this contract are appended. A purchase request has been prepared for an additional quantity of Radio Transmitting Sets AN/PRN-2 based on the revised specification. These items are required for a special purpose. It is probable however, that at least one of each type can be retained for procurement models if this site marking and locating system is standardized.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A VERSATILE PRINTED CIRCUIT SWITCH FOR APPLICATION IN THE LABORATORY AND IN PRODUCTION, by W. H. Hoffmann, Jr. 15 Aug 58, 31p. USASRDL Technical rept. 1976; AD-205 069.
Order from OTS $1.00 PB 161 458

The switch is readily adaptable to practically all electronic circuitry requirements where printed wiring boards are employed for mounting and interconnecting the component electrical parts. Full details of the switch design are shown and examples of various forms of application demonstrated. Included are concentric shaft and multiple decking arrangements. A kit form of the switch is suitable for general experimental use in the laboratory, and the applicability to mass production and automatic assembly methods is stressed.

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth and D. L. Goldwater. Scientific rept. no. 6 on Contract AF 19(604)3904. 15 Oct 59, 17p. AFCRC-TN-59-968.
Order from LC mi$2.40, ph$3.30 PB 145 369

Life studies with thorium impregnated matrix cathodes have been carried to 8600 hours at 1.0 amps/sq. cm., 6000 hours at 2.4 amps/sq. cm. and 1250 hours at 3.0 amps/sq. cm. Studies of the rate of evaporation of thorium from tungsten as a function of temperature and coverage are being continued. (See also PB 143 683)

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING. FINAL REPORT ON TASK XXIV. DESIGN OF RESISTOR LOAD-LIFE FACILITY, by P. G. Perry. Rept. on Contract DA 36-039-sc-63136. 15 Aug 55, 105p. AD-115 175.
Order from LC mi$5.70, ph$16.80 PB 137 516

This is a final report on the design of a semiautomatic facility for investigating the load-life characteristics of resistive components. The primary objective of this program is to provide a complete design, in the form of construction drawings, for an assembly of ovens; electrical circuitry, and instrumentation, so arranged and connected as to provide a convenient system for subjecting all types and sizes of resistors to load-life investigations. (See also PB 136 293)

Battelle Memorial Inst., Columbus, Ohio.
RESEARCH SERVICES IN CONNECTION WITH DESIGNS FOR PYROLYTIC-CARBON VARIABLE RESISTORS, by I. Siegel, J. R. Reichelderfer and others. Final rept. for 15 July 53-14 Feb 55 on Contract DA 36-039-sc-56615. 15 Feb 55, 52p.
Order from LC mi$3.60, ph$9.30 PB 137 550

Carbon and borocarbon films were studied for application as variable-resistance elements. The objectives were to determine the characteristics of these materials for lives of 50,000 wear cycles and 1,000,000 cycles. The studies were concerned with potentiometer characteristics such as wear resistance, rotational life, contact noise, and wiper design as well as general characteristics connected with film resistance elements such as substrate composition, base-surface characteristics, environmental stability, load characteristics, and thermal effects on resistance.

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO ELECTRONIC COUNTING EQUIPMENT, by Richard E. Kimes. Quarterly rept. no. 1, 1 July-1 Oct 54, on Contract DA 36-039-sc-63238. 5 Nov 54, 30p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 145 264

The first phase, the background study is essentially complete. Available published data was accumulated and studied. General study included the theory of the transistor device, its various characteristics, various circuits and circuit applications for the device, and the switching circuits developed in the previous contract. Binary circuits studied were point contact binaries, and two important new circuits: the two transistor junction binary which is an analog to the vacuum tube binary, and a non-saturating point contact which operates at high frequency (1 MC). Life characteristics were studied to determine what power, humidity, and temperature conditions were permissible in available transistors. It seems from accumulated data and experience that a junction transistor is a most reliable device. Data on the testing of transistors was also accumulated.

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO ELECTRONIC COUNTING EQUIPMENT, by Hamilton Chisholm. Quarterly rept. no. 2, 1 Oct 54-1 Jan 55, on Contract DA 36-039-sc-63238. 4 Jan 55, 37p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 145 263

The testing of components is a continuation of work begun at the beginning of the contract. Characteristic curves on the transistors in our possession have been completed. In addition, collector junction capacitance and collector current at cut-off for some of the junction type transistors were measured as an aid to the study of binary design. The bulk of the work for this quarter was performed in the design and study of junction transistor binaries, and in the construction and testing of a decade counter. The latter development is based upon the results of the binary study, and upon a somewhat novel method of obtaining decimal count indication from neon lamp indicators. (Author) (See also PB 145 264)

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO FREQUENCY METER FR-67( )/U, AND MANUFACTURE OF EXPERIMENTAL MODELS, by Hamilton Chisholm and Richard Jiu. Interim rept. for 1 Jan-1 Apr 55 on Contract DA 36-039-sc-63238. 15 May 55, 58p. 6 refs.
Order from LC mi$3.60, ph$9.30 PB 145 261

The component tests were concerned mainly with the characteristic behavior of transistors operating in high and low ambient temperatures. The application of point contact transistors to binary circuits and to ring counter type circuits was investigated. On the basis of this work, the point contact transistors were eliminated from further consideration in this development. The transistorized decade counter development using junction type transistors continued with further circuit refinement. (Author) (See also PB 145 262)

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO FREQUENCY METER FR-67( )/U, AND MANUFACTURE OF EXPERIMENTAL MODELS, by Hamilton Chisholm and Robert Evans. Quarterly rept. no. 3, 1 Apr-1 July 55, on Contract DA 36-039-sc-63238. 13 July 55, 33p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 145 262

The decade counter development has reached the pre-production stage following satisfactory completion by the counters of the required electrical and temperature tests. The control circuit development has been divided into two categories. The first category includes all control elements of the frequency meter such as input amplifier, gate, time base oscillator, and reset circuitry. The early designs of these have been breadboarded and tested for electrical function only. The second category includes the rectifier, filter, and regulation circuits of the power supply. Germanium rectifiers have been used with a completely transistorized regulation circuit which satisfactorily fulfills all the electrical requirements of the power supply (Author) (See also PB 145 263)

Boeing Airplane Co. [Seattle, Wash.]
STUDY OF EQUIPMENT COOLING SYSTEMS, by Fred E. Schroeder, Edward E. Towe and others. Rept. for 1 June 58-30 June 59 on Contract AF 33(616)5784. Nov 59, 173p. 39 refs. WADC Technical rept. 59-253.
Order from OTS $3.00 PB 161 484

This report contains the results of a study of cooling systems for electronic equipment for vehicles operating at velocities of Mach 8.0 to 20.0 at altitudes from 80,000 to 200,000 feet. This envelope includes ballistic and glide re-entry but excludes space and orbital flight and sustained-power aerodynamic flight. Since a portion of the flight of ballistic and glide vehicles is above the atmosphere, all materials used for heat sink, pressurization, heat transport and power generation must be carried on board. It is therefore possible to equate all penalties to take-off weight. Comparisons are presented of expendable heat sink materials, pressurization gases, heat transport fluids and several simplified cooling systems. The effect on system weight of such things as compartment insulation, electric load, leakage, flight time, equipment operating temperature and ground operations are shown. In general, water is the best heat sink and systems employing a liquid heat transport medium are lighter than gaseous systems. A system using water as the heat sink, water or liquid ammonia as the transport fluid and vaporized ammonia for pressurization was the lightest system of those analyzed. (Author)

California U., Los Angeles.
TECHNIQUES FOR THE OPTIMUM SYNTHESIS OF MULTIPOLE CONTROL SYSTEMS WITH RANDOM PROCESSES AS INPUTS, by H. C. Hsieh and C. T. Leondes. Rept. on Contract AF 49(638)438. Sep 59, 42p. 5 refs. AFOSR-TN-59-1132.
Order from LC mi$3.30, ph$7.80 PB 145 488

This report considers the general problem of obtaining the optimum multipole system when the inputs to the system are stationary random processes. The system under investigation is linear and time invariant. The input to each terminal shall consist of signal and noise. The synthesis procedure is carried out under the basis that a fixed plant must be compensated in order to perform certain desired tasks. The design criterion employed is the minimum mean-square error between actual outputs and ideal outputs of the system. A set of integral equations shall be obtained, which can be converted into algebraic equations through transformation. By solving these equations and using the method of undetermined coefficients, the transfer functions of the compensation can be uniquely determined. (Author)

Centre de Physique, Electronique et Corpusculaire (France).
DESIGN AND DEVELOPMENT OF 4 MILLIMETER PROTOTYPE CARCINOTRON TUBES WITH MAGNETS. Final rept. on Contract AF 61(514)919. July 59, 105p. 9 refs. W. R. 411; RADC-TR-59-241.
Order from LC mi$5.70, ph$16.80 PB 145 605

A short survey of the theory of operation of the O Carcinotron in the millimeter range is made and the main features of the design of a tube for the watt level is examined. In the second and third parts the results of the study of the main components of the tube; the gun and the slow wave structure, are reported. The technology of the tube is described in the fourth part; the operating characteristics of different experimental tubes are reported in a fifth part, and the results are compared with the theoretical evaluations. (See also PB 129 438)

Case Inst. of Tech., Cleveland, Ohio.
SYNTHESIS BY CANCELLATION OF ZEROS, by Dov Hazony. Scientific rept. no. 9 on Contract AF 19(604)3887. 21 Dec 59, 8p. 1 ref. AFCRC-TN-59-979.
Order from LC mi$1.80, ph$1.80 PB 145 578

A synthesis procedure is developed in which an arbitrary positive real function Z is represented by means of ζ, also a positive real function, terminating a prescribed realizable four terminal network. ζ is of rank four less than the rank of Z. (Author)

Case Inst. of Tech., Cleveland, Ohio.
A VARIATIONAL INTEGRAL FOR PROPAGATION CONSTANT OF A LOSSY TRANSMISSION LINE, by R. E. Collin. Scientific rept. no. 8 on Contract AF 19(604)3887. 19 Oct 59, 18p. 2 refs. AFCRC-TN-59-959; AD-230 085.
Order from LC mi$2.40, ph$3.30 PB 145 287

By assuming that the current on a lossy transmission line flows in the axial direction only a variational integral for the propagation constant can be readily obtained. This variational integral shows that the usual power loss method of evaluating the attenuation constant is valid for general transmission lines. This variational integral also shows that the perturbation of the loss free phase constant is due to the increase in magnetic field energy caused by penetration of the field into the conductors. (Author)

Centre de Physique, Electronique et Corpusculaire (France).
DESIGN AND DEVELOPMENT OF UHF PROTOTYPE CARCINOTRON TUBES WITH MAGNETS. Addendum to Final rept. on Contract AF 61(514)917. Sep 59, 81p. W. R. 448; RADC-TR-59-242.
Order from LC mi$4.80, ph$13.80 PB 145 606

See also PB 145 605

Centre de Physique, Electronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE TCM14 AND TCM16, by G. Wendt. Rept. on Proj. NR-048-140. 1 Dec 58, 24p. WR. 348.
Order from LC mi$2.70, ph$4.80 PB 145 068

Centre de Physique, Electronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE TCM 14 AND TCM 16, by G. Wendt. Rept. on [Project NR-048-140]. 1 Mar 59, 24p. W. R. 383.
Order from LC mi$2.70, ph$4.80 PB 145 585

The present report is concerned with the last results on the tube T C M 14 (tests on a "ceramic" target) and with the first experiments on the design of a tube T C M 16 having a linear gun. (See also PB 145 068)

Chatham Electronics, Livingston, N. J.
RESEARCH STUDY AND DEVELOPMENT OF CLIPPER TUBE, GAS FILLED, by John J. McArtney. Final rept., phase 2, 1 Oct 56-14 Nov 57, on Contract DA 36-039-sc-64621. [1957] 193p.
AD-218 800.
Order from LC mi$8.70, ph$30.30 PB 145 226

General design requisites for clipper tubes are listed, and various structures employing inverted cup anodes and grids are described. The evolution of the tube from its inception down to the "final center fire" design is detailed. The methods used to reduce sputtering are discussed as well as the solution to problems of obtaining fast ionization time. A cathode designed to deliver a peak current of 325 amp (steady state) with occasional fault demand peaks of 1200 amp is shown. This cathode is tentatively rated for an rms current of 6.3 amp and it is believed capable of considerably higher values. The design of

a fast heating reservoir, capable of three minutes heating with capacity to supply hydrogen over the anticipated tube life is described. A detailed cross section of the CH 1078 clipper tube is presented together with complete information on constructional details and processing. A tentative clipper diode design has been established. These tubes have undergone limited testing both as hold-off diodes and as clippers. Results to date are encouraging. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
AN AMPLITUDE DISTRIBUTION FUNCTION ANALYZER, by Elliot E. Austein. Scientific rept. no. 3 on Radio Scattering in the Troposphere, Contract AF 19(604)3494. 1 Aug 59, 97p. 18 refs. Research rept. EE 434; AFCRC-TN-59-950.
Order from LC mi$5. 40, ph$15. 30 PB 145 549

A single-channel, sweep-type, amplitude-distribution function analyzer is described and evaluated. The instrument measures and plots directly on an Esterline-Angus graphic milliammeter a graph of signal amplitude versus the fraction of the time during which the signal lies below that amplitude. The analyzer generates a voltage waveform whose short-time average value is proportional to the time during which the signal lies below a threshold level. The average value is computed by a low-pass RC filter, whose output is monitored continuously by the recording milliammeter. The threshold level sweeps slowly through the amplitude range of the signal and is proportional to the position of the recorder chart in the milliammeter.

David Sarnoff Research Center, Princeton, N. J.
DEVELOPMENT OF PLASMATRON GASEOUS DISCHARGE TUBES, by E. O. Johnson. Final rept. for 7 Sep 51-31 May 54 on Contract DA 36-039-sc-15401. 29 July 54, 224p. 30 refs.
Order from LC mi$9. 90, ph$34. 80 PB 145 342

A detailed discussion is given of the theory, operation, and construction of two different types of ten-ampere hot cathode gas tubes, which provide high efficiency inverter operation at low supply potentials. One of these, a low drop thyratron, is shown to give the same overall efficiency as the other, a plasmatron, and at the same time be much more practical. The low drop thyratron, to which most of this report is devoted, is shown to derive its unusually low tube drop from the effective use of a type of hot cathode discharge known as the "ball of fire" mode. It is shown that the anode efficiency of the final design tube is close to the theoretical maximum. Inverter operation for both the plasmatron and low drop thyratron operation is considered and typical test results are given. A discussion is given of the theory, operation, and design of hot cathode discharges which can provide noiseless operation and make possible practical grid cut-off of the anode current. The construction and operating details are given for ten inverter tubes of the ten ampere size, two plasmatrons and eight low drop thyratrons, that were delivered to the Signal Corps in fulfillment of the contract tube requirements.

David Sarnoff Research Center, Princeton, N. J.
THERMIONIC EMISSION STUDIES, by G. A. Morton, A. H. Sommer and others. Quarterly rept. no. 1, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-78155. [1958] 22p. 1 ref.
Order from LC mi$2. 70, ph$4. 80 PB 145 236

A survey of the various materials which may have low electron affinities is given. More promising materials include MgO, carbides, nitrides, the halides of the alkali and alkaline earths, and ionic compounds of the rare earths. "Hot electron" emission has been obtained under D. C. operation from Si diodes after a Cs surface treatment.

Edgerton, Germeshausen and Grier, Inc., Boston, Mass.
12 MW CERAMIC HYDROGEN THYRATRON, by Seymour Goldberg and Daniel F. Riley. Final rept. on Contract DA 36-039-sc-73161. 13 June 58, 105p. 23 refs. AD-203 574.
Order from LC mi$5. 70, ph$16. 80 PB 145 406

This report presents a general description of the design of the 12-megawatt, ceramic-metal envelope hydrogen thyratron, as well as specific data on the design and construction of the seals, cathode, grid, and anode. The development of a vane-type cathode has been one of the major undertakings of the tube-development program. Factors influencing the design of hydrogen reservoirs were investigated. A study was also made of the warmup characteristics of the tube, and the factors influencing warmup. Evaluation of the 1802 tube was carried out according to the conditions stipulated in Signal Corps. Specification SCL-5319. Life tests have demonstrated the ability of the tube to operate at a 50 kc pulse repetition rate and at 5948/1754 condition two for 1000 hours of life. They have further demonstrated life at 5948/1754 condition one for 800-900 hours. The cathode exhaustion problem which limited life at condition one has been relieved. Preliminary shock and vibration tests were also conducted. The more pertinent thyratron processing techniques are described, and data obtained from the hydrogen cleanup investigation are presented. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
THE TIME ELEMENT IN PHOTOELECTRIC EMISSION, by D. F. Holshouser (Doctoral thesis) and H. M. Von Foerster. Final technical rept. on Contract AF 18(600)1018. June 58, 98p. 27 refs. AFOSR-TR-58-67; AD-158 274.
Order from LC mi$5. 40, ph$15. 30 PB 137 696

It was the purpose of this investigation, not to analyze the mechanisms involved in photoelectric emission, but to actually measure the degree of photoelectric response of transmission-type cesium-antimonide photocathodes to light pulses of 100 μμsec duration, i. e., pulses about one order of magnitude shorter than have been previously reported. Cesium-antimonide was chosen because of its high quantum yield and because of its widespread application.

Electron Tube and Microwave Lab., Calif. Inst. of Tech., Pasadena.
BEHAVIOR OF TRAVELING-WAVE TUBES NEAR CIRCUIT CUTOFF, by Daniel G. Dow. Technical rept. no. 10 on Contract Nonr 220(13). Feb 59, 41p. 6 refs. AD-214 439.
Order from LC mi$3.30, ph$7.80 PB 145 257

A theory is developed which explains the operation of a traveling wave tube when operated near the cutoff frequency of the slow wave circuit, including the effect of two circuit waves instead of the usual one. The theory is normalized in a manner analogous to that used in more conventional analyses, making a relatively small number of curves applicable to a large number of cases. The relationship between this theory and the 3-wave theory usually used in traveling-wave tube analysis is shown, and they are in agreement when the system is operated far from the cutoff frequency. Numerical results are given for a range of parameters which might be useful in traveling wave tube design, and an excellent agreement with published experimental results is shown. (Author)

Electronics Research Lab., U. of California, Berkeley.
ANTENNA ANALYSIS IN GENERAL WITH SPECIFIC REFERENCE TO FREQUENCY INDEPENDENT ANTENNAS, by V. H. Rumsey. Rept. on Contract N7onr-295(29). 25 Feb 59, 31p. Rept. no. 82; IER Series no. 60, Issue no. 230.
Order from LC mi$3.00, ph$6.30 PB 145 497

The general problem of transmission between antennas is solved in terms of field theory formulas for self and mutual impedance. Simple formulas for the radiation patterns of antennas on spheres, cylinders, and cones are derived in terms of the solution for a plane wave incident on a sphere etc. Various uniqueness theorems are obtained together with practical applications. A general eigenfunction expansion for the reaction is derived and used to give the transmission between antennas in a waveguide or near a sphere, as examples. Several forms of Huygens' principle are discussed. It is shown that the field diffracted through a hole in a plane metal screen is the same as the field in free space of a specific combination of electric and magnetic dipoles distributed around the rim of the aperture.

Electronics Research Lab., U. of California, Berkeley.
DELAY TIME IN DOMINANT POLE CIRCUITS, by D. O. Pederson and G. W. Wilson. Rept. on Contract N7onr-295(29). 5 Feb 59, 26p. 5 refs. Rept. no. 80; Series no. 60, Issue no. 228.
Order from LC mi$2.70, ph$4.80 PB 145 495

In many linear active and passive circuits, a dominant pole description can be made of pertinent network functions. That is, the network function can be approximated over a frequency or time interval by one pole or natural frequency. Major effects such as bandwidth or rise time are then easily established. However, information on second order effects such as propagation time through the circuit is eliminated. In this report, investigation is made of the conditions necessary for a dominant pole description and simple formulas are derived to estimate the delay time of a dominant pole circuit. The final results are expressed in terms of the coefficients of the network function; hence, it is not necessary to factor the rational function in order to establish whether a dominant pole condition exists or what the delay time will be.

Electronics Research Lab., U. of California, Berkeley.
A NOTE ON SIMPLIFIED TRANSISTOR EQUIVALENT CIRCUITS, by D. O. Pederson. Rept. on Contract N7onr-295(29). 5 Feb 59, 16p. 3 refs. Rept. no. 81; IER Series no. 60, Issue no. 229; AD-215 555.
Order from LC mi$2.40, ph$3.30 PB 145 496

Through the use of these simpler circuits a great deal of modern network technology can be easily and with physical insight applied to the study and design of transistor circuitry. In this report, certain of these simple equivalent circuits are investigated and/or clarified. In particular, two topics are given most attention: the problem of excess phase and the incorporation of the depletion layer capacitance to obtain a dominant pole response. The starting point will be the equivalent circuits shown in Fig. 1, the familiar T circuit. Attention will be restricted to the medium frequency range $\frac{1}{r_c C_c} < \omega < \omega_a$. In this frequency range, the effects due to base width modulation can be ignored.

Electronics Research Lab., U. of California, Berkeley.
SHUNT-PEAKED TRANSISTOR AMPLIFIERS, by R. S. Pepper and D. O. Pederson. Rept. on Contract N7onr-29529. 13 Apr 59, 27p. 13 refs. Rept. no. 85; IER Series no. 60, Issue no. 234.
Order from LC mi$2.70, ph$4.80 PB 145 696

This paper is concerned with the analysis, comparison, and design of broad-banded, low-pass transistor amplifiers. The configurations studied in this paper, by which broadbanding can be achieved, are common-emitter stages with resistive, series-peaked, or shunt-peaked interstages, and common emitter stages with a parallel RC network in the emitter lead.

Electronics Research Lab. U. of California, Berkeley.
STRIPLINE BETWEEN CURVED BOUNDARIES, by Gerald August. Rept. on Contract N7onr-295(29). 5 Mar 59, 73p. 37 refs. Rept. no. 83; IER Series no. 60, Issue no. 231; AD-218 666.
Order from LC mi$4.50, ph$12.30 PB 145 498

A stripline transmission junction is examined, in which the center strip lies between ground planes which are sections of concentric cylinders. It is concluded that impedance changes are negligible and that transmission through the junction is virtually unaffected for a wide variety of ground plane curvatures.

However, sizeable changes in radiation leakage occur. The relation of flat stripline to curved stripline is treated. The curved stripline of this report is shown to represent a general class of curved striplines. A stripline in the form of a transmission junction, having as variables the center strip width and the ground plane curvature, is investigated over the frequency band 8500 to 9900 mc. Impedance, scattering matrices, and radiation leakage are experimentally determined.

Electronics Systems Lab., Mass. Inst. of Tech., Cambridge.
THE ANALYSIS AND DESIGN OF DIGITALLY-CONTROLLED INSTRUMENT SERVOS, by Ralph Scheidenhelm. Rept. on Contract N61339-301. June 59, 88p. 15 refs. Technical rept. NAVTRADEVCEN 7890-TR-1.
Order from OTS $2.25 PB 161 020

This report analyzes the effects of time-sampling and amplitude quantization of output and error signals on the performance of a second-order instrument servo which is to be controlled by a digital computer. Two configurations are considered. One is a high-performance type, capable of reproducing sine-wave inputs with a low-frequency phase-shift equivalent to a delay of one-half sampling period and a resonance peak of 2 at a frequency of one-fourth the ampling frequency. The second configuration employs a logarithmic level-selection scheme for the computer output signal. This considerably reduces the number of discrete levels in the decoding of the computer signal required to achieve a given resolution and maximum output shaft rate. Application of the design techniques is made to an instrument servo which converts the signals generated in a digital operational flight trainer to the analog pointer positions of the cockpit instruments. (Author)

Electronics Systems Lab., Mass. Inst. of Tech., Cambridge.
A SIMULATOR STUDY OF TWO-DIGITALLY-CONTROLLED INSTRUMENT SERVOS, by Ralph Scheidenhelm and Yngvar Lundh. Rept. on Contract N61339-301. June 59, 72p. 5 refs. Technical rept. NAVTRADEVCEN 7890-TR-2.
Order from OTS $2.00 PB 161 021

In this simulator study, an analog output member controlled by the TX-O digital computer was used for experimental verification of two digitally-controlled instrument servo configuration studied analytically in a previous report. Physical simulation permitted investigation of the effects of quantization in the output signal and decoded computer drive signal. One servo uses a combination of digital and analog compensation to realize a sine-wave response peak of 2 at a frequency of one-fourth of the sampling frequency, and a time delay in following a ramp input of one-half the sampling period. The other servo, which has lower dynamic requirements, employs a selection program which reduces the number of drive signal levels requiring decoding. The selected levels are in logarithmic sequence $\pm$(0, 1, 3, 9, 27---) rather than the usual linear sequence (0, 1, 2, 3, ---). The experimental results confirm the analysis of Report 7890-TR-1. (PB 161 020).

General Electric Microwave Lab., Palo Alto, Calif.
MEASUREMENT AND CONTROL OF HARMONIC AND SPURIOUS MICROWAVE ENERGY, by Gabriel Novick and Vernon G. Price. Final rept. Phase 3 for Mar 58-Apr 59 on Contract AF 30(602)1670. 15 May 59, 86p. 13 refs. Rept. TIS R59ELM112-3; RADC-TR-59-172.
Order from LC mi$4.80, ph$13.80 PB 145 604

The mechanism for the generation of unwanted signals in high power microwave tubes was studied qualitatively and is reported, along with the following several techniques for suppression of these signals (all suggested methods being other than external filtering): (1) by modulator design, (2) by drive signal filtering, (3) by undesired signal monitoring, (4) by mode suppression and integral filter, and (5) by improved tube design. A cold-test model integral filter tube was made, and the incorporation of a harmonic filter in the vacuum envelope was found to be feasible. (Author) (See also PB 142 935)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 1, 1 Jan-1 Apr 51, on Contract DA 36-039-sc-5410. [1951] 18p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 138 157

A search of the literature has been made for phenomena which can be used for the accurate control of frequencies above 150 Mc. Certain phenomena have been considered in some detail. These are: (1) molecular resonances in gases at lower frequencies than have as yet been investigated by the techniques of microwave spectroscopy; (2) nuclear quadrupole resonances in crystalline compounds, particularly iodine compounds; (3) magnetic resonances, both nuclear and electronic. Tentative conclusions have been reached concerning the practicability of applying each of the above effects to the control of a frequency in the range of interest.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 2, 1 Apr-1July 51, on Contract DA 36-039-sc-5410. [1951] 37p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 138 156

Work on nuclear magnetic resonance, begun in the previous period, has been continued and extended. It has been found that the response of available materials in the frequency region of interest is quite weak; therefore a sensitive detection method is necessary. A bridge method has been selected as best fitting the needs of the present project. A bridge for this purpose is being designed; moreover, it appears that the bridge and associated detection circuits may be modified to generate oscillation under control of the magnetic resonance. The use of cavity resonance for frequency control has received additional study. The open-circuited half-wave coaxial

structure has been tentatively selected as most appropriate to the present needs. The properties of circuits suitable for use with cavity resonators are being studied. To this end a brass cavity having a Q of about 800 at 185 Mc. has been constructed. (See also PB 138 157)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 3, 1 July-1 Oct 51, on Contract DA 36-039-sc-5410. [1951] 48p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 138 155

The bridge unit for the detection of nuclear magnetic resonance has been constructed, and associated circuits are nearly complete. Several of the circuits have been tested and found to operate correctly; however, the complete system must be assembled and tested before satisfactory performance is assured. Four open-circuited half-wave coaxial resonators have been designed and their construction is approximately half completed. The designs are quite similar, but differ in such a way as to permit evaluation of different materials and constructional methods. The first objective is to obtain a design which has an intrinsically small and cyclic frequency variation with temperature. Compensation methods to reduce the temperature coefficient further will be sought as a second objective. General relationships have been established between impedance, selectivity and susceptance slope. (See also PB 138 156)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 4, 1 Oct 51-1 Mar 52, on Contract DA 36-039-sc-5410. [1952] 35p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 138 154

The system for detection of nuclear magnetic resonance has been assembled and tested. In its present form the system differs from that described in Progress Report No. 3 in several respects. The amplifier supplies a stable gain of 110 db, and its center frequency has been changed from 455 kc to 1.5 Mc. The input and output modulators have been redesigned to simplify tuning and impedance matching, and the bridge coupling circuits have been modified to account for the reactive component of the bridge impedance. At present, spurious coupling exists between the input and output modulators. Active steps are being taken to locate and eliminate the cause of this trouble. A resonator-controlled oscillator has been tested and found to have a temperature coefficient of frequency of approximately 2.4 parts per million per degree C. (See also PB 138 155)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by Vernon Crawford and James C. Hogg, Jr. Progress rept. no. 5, 1 Mar-1 June 52, on Contract DA 36-039-sc-5410. [1952] 27p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 138 153

Several spectrometers for the detection of nuclear magnetic resonances over a frequency range near 30 Mc have been constructed and tested. One of these has proved successful, and quadrupole resonances have been observed in sodium chlorate, potassium chlorate, paradichlorobenzene and chloroform. Remedies have been found for a number of conditions which interfere with the detection of resonances. (See also PB 138 154)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by Vernon Crawford and James C. Hogg, Jr. Progress rept. no. 6, 1 June-1 Sep 52, on Contract DA 36-039-sc-5410. [1952] 23p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 152

Modifications of the previously described nuclear quadrupole spectrometer, which operates in the 30 Mc range, have permitted the detection of resonances in sodium chlorate samples with signal-to-noise ratios greater than fifteen-to-one. Moreover, the detector has shown a perceptible tendency to lock in frequency with the quadrupole resonance. A method of partial compensation for the residual temperature coefficient of frequency in stable coaxial resonators has been analyzed, and design procedures have been evolved. (Author) (See also PB 138 153)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by Vernon Crawford, James C. Hogg, Jr. and William H. Bradley. Progress rept. no. 7, 30 Sep-1 Dec 52, on Contract DA 36-039-sc-5410. [1952] 30p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 138 151

A quarter-wave coaxial resonator has been constructed and tested. While the performance of this unit with respect to sensitivity to vibration is superior to previously constructed half-wave units, its temperature coefficient of frequency is inferior, being approximately three parts per million per degree centigrade. Responses from the nuclear quadrupole resonances of sodium bromate have been observed at 150 Mc and 179 Mc. These responses have the highest signal-to-noise ratio of any responses observed on this project. A modified spectrometer and sample holder promises to enable observation of nuclear quadrupole resonances up to 300 Mc. A correlation between quadrupole coupling constants and electronegativity difference has been observed. (See also PB 138 152)

nominal center frequency of 600 megacycles but may

low temperature sensitivity by means of compens

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MEGACYCLES, by Vernon Crawford and James C. Hogg, Jr. Final rept. on Contract DA 36-039-sc-5410. 31 Jan 53, 134p. 7 refs.
Order from LC mi$6.90, ph$21.30 PB 138 150

The theories of magnetic and quadrupole resonances are presented, as are the experimental results obtained with several quadrupole spectrometers. Correlation between quadrupole coupling constants and electronegativity difference has been observed, and a basis for prediction of hitherto unobserved resonances has been established. Quadrupole resonances were observed at a number of frequencies between 30 Mc and 179 Mc, but no successful method of frequency control by this means has been devised. The design and construction of stable coaxial resonators is described, and experimental results obtained with one unit. The direct relationship between selectivity, or Q, and susceptance slope is demonstrated. (Author) (See also PB 138 151)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Vernon Crawford and Donald W. Fraser. Progress rept. no. 3, 1 Aug-1 Nov 53, on Contract DA 36-039-sc-42590. [1953] 43p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 138 186

During the present quarter the principle of temperature compensation, previously applied to coaxial cavities resonating at 300 megacycles, has been extended to resonators designed for the 600-megacycle range. Variations in construction from the earlier models have been included. Considerable investigation of cavity-controlled oscillators has been conducted. An analytical investigation of the input admittance of a loop-coupled cavity has been made. Curves of input conductance, susceptance, and phase angle are presented as tools which are useful in the design of cavity-controlled oscillators. Further investigation on the high overtone responses of quartz crystals have been carried out. Unmounted crystal blanks have yielded weak responses in the 200 to 300-mc region. (See also PB 138 185)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Donald W. Fraser. Progress rept. no. 4, 1 Nov 53-1 Feb 54, on Contract DA 36-039-sc-42590. [1954] 41p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 138 187

There have been four objectives emphasized during the period of this report. Measurements to determine the characteristics of 600-mc coaxial-cavity resonators have been conducted, theoretical and experimental attention has been devoted to a series-tuned cavity-controlled oscillator, consideration has been given to a method of automatic frequency control utilizing the high-order overtone response of a quartz crystal and some time has been directed toward a literature study of novel means of frequency control. The three 600-mc cavities completed during the previous quarter have been subjected to careful scrutiny. A cavity-controlled oscillator consisting of an internally-mounted tube and a small series capacitor is undergoing theoretical and experimental study. Some attention has been given to the automatic frequency-control problem. A limited literature search brought up several novel methods of frequency control in the lower UHF region. (See also PB 138 186)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 mc AND HIGHER) by Donald W. Fraser. Progress rept. no. 5, 1 Feb-1 May 54, on Contract DA 36-039-sc-42590. [1954] 40p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 138 188

Two primary objectives have been emphasized during the period of this report. The first has been the continued development of coaxial-cavity resonators of minimum temperature sensitivity, the second has been an effort to determine optimum methods of construction of cavity-controlled oscillators in the 500-to 1000-megacycle region. Three models of cavities have been developed. The first, using a brass outer conductor and a silver-plated Pyrex inner conductor, is temperature-compensated. It is provided with an arrangement which permits resonator tuning without affecting the hermetic sealing which permits resonator tuning without affecting the hermetic sealing which is required to eliminate the effects of humidity on frequency stability. A second cavity, utilizing a Vycor center conductor, is uncompensated and nontunable. The third utilizes a center conductor which is constructed of Invar and which is rigidly secured to a brass end-plate. Of the three cavities, the first two have demonstrated results which are considered to be satisfactory. Continued attention has been devoted to cavity-controlled oscillators using a small series capacitor. Experiments to determine the effect of characteristic impedance and of physical size of the cavity have been conducted. An oscillator which has demonstrated frequency stabilities of better than one-half part per million and is tunable over a 20 per cent frequency range near 500 mc has been constructed. (See also PB 138 187)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 mc AND HIGHER) by Donald W. Fraser and Edward G. Holmes. Progress rept. no. 6, 1 May-1 Aug 54, on Contract DA 36-039-sc-42590. [1954] 48p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 138 189

During the period of this report, continued efforts have been directed toward improvement of series-capacitor cavity-controlled oscillators. Three hermetically sealed assemblies of this type have been constructed. Each of these three oscillators has a

nominal center frequency of 600 megacycles but may be tuned over an approximate 60-megacycle band by adjusting the series capacitor. Some consideration has been given to the practicability of stabilizing oscillators by synchronization processes, and limited tests have been conducted in the UHF region. It has been demonstrated that synchronization of conventional UHF oscillators is feasible at frequencies up to 800 megacycles using either the fundamental, second harmonic or third harmonic of the synchronizing voltage. In the field of automatic frequency control a reactance-tube oscillator combination using a half-wave coaxial cable as a tank circuit shows promise of extending the frequency range of conventional reactance tubes into the upper VHF region. (See also PB 138 188)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Donald W. Fraser and Edward G. Holmes. Progress rept. no. 7, 1 Aug-1 Nov 54, on Contract DA 36-039-sc-42590. [1954] 38p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 138 190

A primary objective during the period of this report has been the accurate determination of the frequency stability of several cavity-controlled oscillators which operate in the 500-800-mc region. A secondary objective has been the determination of the heat-transfer characteristics of coaxial cavities constructed in entirety of the nickel-steel alloy, Invar. A third, and minor, objective has been a re-examination of the possible utilization of ceramic materials in electrical resonators. Investigations of ceramic bases in electrical resonators have been pursued, and new methods of attaching conductive coatings have been pursued, and new methods of attaching conductive coatings have been tested. (See also PB 138 189)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Donald W. Fraser and Edward G. Holmes. Final rept. for 1 Nov 54-30 Apr 55 on Contract DA 36-039-sc-42590. [1955] 155p. 18 refs.
Order from LC mi$7.50, ph$24.30 PB 138 191

This report contains all the important aspects of the seven previous progress reports and coordinates a number of subjects which previously appeared isolated and detached. In addition, experimental and theoretical work which was accomplished in the final quarter is presented. Primary attention has been devoted to the design, construction, and testing of coaxial-cavity resonators, and particular emphasis has been placed upon methods of rendering these cavities insensitive to temperature variations. A description of several resonators which have attained low temperature sensitivity by means of compensation or by use of materials of low expansivity is presented. The remainder of the report is devoted to a compilation and coordination of numerous topics which appeared in somewhat isolated forms in various progress reports. (See also PB 138 190)

Haloid Co., Rochester, N. Y.
PERFORMING RESEARCH ON NEW APPROACHES TO PRINTED CIRCUITRY. Final rept. for 1 Mar 56-15 Nov 57 on Contract AF 19(604)1736. 30 Nov 57, 85p. 10 refs. AFCRC-TR-58-103; AD-146 803.
Order from LC mi$4.80, ph$13.80 PB 137 520

Two independent methods for producing printed circuits and components were developed. Both utilized the idea of placing layers of conductive and resistive materials on ceramic substrates and of subsequently selectively etching these layers to produce the components. In one method, the conductive, resistive, and, sometimes dielectric, layers were deposited by vacuum evaporation techniques; in the other, a combination of chemical deposition techniques, such as hot spraying and electroplating, were employed. Selectivity in the etching process was of 2 kinds: (1) differential etching solutions were employed (etching solutions capable of attacking and removing the top layer of a double-layer blank but incapable of attacking the underlying layer), and (2) the geometrical patterns in the etched layers were controlled by means of a xerographically applied chemical resist. Up to 300°C, conductive lines, resistors, and soldered connections were formed either by vacuum evaporation or chemical deposition. The chemical deposition method had an advantage over the vacuum deposition technique in yielding circuits capable of operating in excess of 300°C without employing protective coating. Capacitors formed by vacuum deposition were not capable of operation in excess of 200°C; the prospect of producing capacitors capable of operating at higher temperatures appeared to be good. Above 300°C, only the chemical deposition method for forming printed circuits and components was promising. Conductive lines, connectors, and resistors formed by this method were capable of prolonged operation, without hermetic sealing, at 500°C.

Hughes Aircraft [Labs.] Culver City, Calif.
DUAL MODE BEACON ANTENNA WITH POLARIZATION DIVERSITY, by H. H. Hougardy. Scientific rept. no. 3508/5 on Contract AF 19(604)3508. Aug 59, 27p. 6 refs. AFCRC-TN-60-100.
Order from LC mi$2.70, ph$4.80 PB 145 565

The theoretical analysis and experimental results for an annular aperture antenna with a beacon-type pattern and polarization diversity are presented. The antenna considered consists of a dual orthogonal mode ring waveguide which has crossed-slot radiating elements cut in one of the planar faces. Either right- or left-handed circular polarization characteristics are realized by the use of a single ring of slots. With two rings arrayed, polarization of any type can be obtained. (Author)

Hycon Eastern, Inc., Cambridge, Mass.
THEORY OF TWO-LEVEL MASERS, by J. L. Burkhardt, J. W. Culvahouse and others. Final rept. on Contract Nonr-2254(00). 3 Feb 58, 217p. 37 refs. M-431; AD-152 793.
Order from LC mi$9.60, ph$33.30 PB 138 136

Classical and quantum-mechanical treatments of paramagnetic resonance in isolated atoms and in assemblies of such atoms are presented. Interactions of paramagnetic ions with crystalline fields are discussed in detail. Relaxation times are introduced phenomenologically and later treated more thoroughly in terms of the dipole-dipole and ion-phonon interactions. Power transfer between paramagnetic material and electromagnetic field is calculated in both macroscopic and microscopic terms. The circuit properties of various amplifier configurations are then derived, and expressions are given for gain, bandwidth, noise figure, stability, etc. From the theory presented, it becomes clear that a reflection-cavity-with-circulator system will give better performance in every respect than a transmission-cavity.

ITT Labs., Nutley, N. J.
AN EVALUATION OF THE STABILITY AND ACCURACY OF A BREADBOARD MODEL OF A CESIUM GAS CELL ATOMIC FREQUENCY STANDARD, by M. Arditi. Final engineering rept. for 1 Apr-31 Dec 58 on Contract Nonr-2553(00). Feb 59, 239p. 74 refs. ITT Technical memo no. 747.
Order from LC mi$10.20, ph$36.30 PB 145 079

A description is given of a breadboard model of a cesium gas cell atomic frequency standard which has been evaluated for stability and accuracy. Short-time stability of ± 2 to 4 parts in 10^{10}, long-time stability of ± 1 part in 10^{10}, and accuracy of ± 3 to 4 parts in 10^{10} have been measured. Performances an order of magnitude better are predicted. The design of the gas cell lends itself quite easily to packaging. However, some development is still necessary to improve the life of the light source over its present value of about 100 hours. (Author)

Linfield Research Inst., McMinnville, Oreg.
RESEARCH ON FIELD EMISSION CATHODES, by E. E. Martin, F. M. Charbonnier and others. Research on Particle Physics of Electronic Components, Contracts AF 33(616)(304, 3247, 3851, and 5404). Jan 60, 143p. 51 refs. WADD Technical rept. 59-20.
Order from OTS $2.75 PB 161 526

Design data are presented which allow simple prediction of the electrical performance of field emission cathodes from a knowledge of cathode geometry, work function, and position relative to the tube anode. A theoretical treatment of energy exchange phenomena associated with the emission is given; resistive heating of the tip by the emitted current, heating and cooling effects due to emission of electrons at other than the Fermi energy, and cooling of the tip by both thermal radiation and conduction down the emitter shank are considered; experimental verification of this theory confirms the possibility of drawing current densities in excess of 10^7 amp/cm^2, even for cw emission. Use of the field emission cathode in voltage regulation and rectification circuits, electron optical applications, and microwave devices is discussed. Factors affecting the electrical stability of the emission are outlined, and techniques which, through improvement of emitter environment, have resulted in betterment of stability by five orders of magnitude and stable 1000 hour emission of several milliamperes of dc current are reported. Properties of a number of emitting surfaces are discussed. The electrochemistry of tungsten and its application in the fabrication of field emission tips are treated. Associated techniques are reported which include: the working of alumino-silicate glasses, methods used for achievement of ultra-high vacuum, controlled re-orientation of tungsten crystals by floating zone melting and the use of electric field to inhibit geometric deformation of heated field emitters. (Author) (See also PB 151 552)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and A. Botka. Quarterly rept. no. 1, 15 Jan-15 Apr 57, on Contract DA 36-039-sc-73143. 15 Apr 57, 13p. 22 refs. AD-133 401.
Order from LC mi$2.40, ph$3.30 PB 145 402

Methods are to be studied for reducing inelastic wall collisions, with particular emphasis on the development of reflective wall coatings for atomic frequency standards. The existing knowledge of the interaction of adsorbed atoms with surfaces is reviewed. An optical experiment for studying the destruction of the alignment of alkali atoms in wall collisions is suggested.

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL, COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and others. Quarterly rept. no. 2, 15 Apr-15 July 57, on Contract DA 36-039-sc-73143. 15 July 57, 56p. 90 refs. AD-141 515.
Order from LC mi$3.60, ph$9.30 PB 145 403

The progress of experimental and theoretical work carried out under this contract is reviewed. Computations on the separation of closely spaced spectral lines, and on a new method of atomic orientation by optical pumping, are presented. A bibliography on surface interactions is appended. Included is a report entitled Atomic Orientation by Optical Pumping. (Author) (See also PB 145 402)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and others. Quarterly rept. no. 3, 15 July-15 Oct 57, on Contract DA 36-039-sc-73143. 15 Oct 57, 25p. 7 refs. AD-153 112.
Order from LC mi$2.70, ph$4.80 PB 145 404

Further work was done on methods for reducing inelastic wall collisions. Of the methods for producing the interaction of aligned alkali metal atoms with a surface, optical pumping of a buffered vapor appeared the most promising from the simplicity of the apparatus required and the speed with which definite results could be obtained. It was felt that Dehmelt's experiment (Phys. Rev. 105:1487, 1957) could be adapted for the purpose of studying surface relaxation. Changes were made, however, to Dehmelt's original experiment. One change involved redesign of the gas cell increasing the wall temperature by 30° to 50°C over the sodium reservoir temperature. By varying the sodium vapor pressure, the contribution of electron exchange to the spin relaxation of the sodium can be separated from other forms of relaxation. Another change involved filtering out one of the 2 D-lines of the pumping radiation to make the pumping process more or less independent of the buffer-gas pressure. To achieve a uniform illumination of the entire gas volume, the ratio of wall area to volume of the gas cell was maximized by employing a cylindrical container with a 4:1 ratio of length to diameter. (See also PB 145 403)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and H. Lerch. Quarterly rept. no. 4, 15 Oct 57-15 Mar 58, on Contract DA 36-039-sc-73143. 15 Mar 58, 31p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 145 405

This report discusses modifications that have been made in the apparatus for the study of wall relaxation of aligned alkali metal atoms. The progress of experimental work is discussed, and a detailed analysis of two different methods for measuring relaxation times is presented. (Author) (See also PB 145 404)

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry, and C. A. Stevens. Quarterly rept. no. 1, 1 Sep-30 Nov 56, on Contract DA 36-039-sc-72833. [1956] 24p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 145 227

Regions of frequency-dimension space additional to those of previous contract work for flat rectangular AT-cut quartz plates have been examined for identification and plotting of modes which could be compared with Mindlin's theory, and for those modes good agreement is shown.

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins and R. W. Perry. Quarterly rept. no. 2, 1 Dec 56-28 Feb 57, on Contract DA 36-039-sc-72833. [1957] 20p. 5 refs. AD-138 885.
Order from LC mi$2.40, ph$3.30 PB 145 228

The instrumentation necessary for working at much higher frequencies is being developed while studies are continuing on the normalized frequency-dimension curves and the vibration distribution patterns for flat circular AT-cut plates. Flat plates, fully electroded, are being used to insure that the various orders of modes will most likely be present as strongly as possible, and to test the theory for flat-plate piezoelectric crystals. Some of the modes were identified, and the functions for them compared with theoretical prediction. Three methods for mode identification are being used (1) the passive probe pressure pattern technique, (2) finely divided powder or liquid patterns, and (3) a photo-etch method of applying precisely shaped and aligned electrodes to the major crystal faces. The series resistance of a mode shows a high correlation with the amplitude of the spectral response observed on the crystal response spectrometer. The resistance of the fundamental thickness shear as measured on the crystal impedance meter gives a good indication of the degree of coupling, especially with flexural modes, to which it is subjected. New and precise tools and fixtures are being built for use with the higher frequency, very thin crystals required for the higher reaches of d/h ratios. (See also PB 145 227)

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry and others. Quarterly rept. no. 3, 1 Mar-31 May 57, on Contract DA 36-039-sc-72833. [1957] 28p. 2 refs. AD-139 174.
Order from LC mi$2.70, ph$4.80 PB 145 229

Studies were continued on the normalized frequency-dimension curves and the vibration distribution patterns for flat circular AT-cut plates. The region just below the diameter/thickness (d/h) value of 20 was investigated. Charts of experimental normalized frequency-dimension data are presented with theoretical predictions of first-order asymmetric curved for the same region superimposed. Other orders, not predicted, also appear in the experimental plots and illustrate how the fundamental thickness-shear mode is almost never free of coupling to some flexure or other. A probe diagram and photographs of powder patterns of 2 modes illustrate the methods of identifying modes. Masks were made to stimulate axially symmetric modes (selective mode excitation). A high degree of correspondence was shown in comparing modes between the amplitude of the response on the crystal response spectrometer and the series resonant conductance read with the CI meter. The degree of coupling experienced by the fundamental thickness shear with flexural or other modes is reflected in the measurements of its series resonant resistance. The new microprobing device for use with very thin piezoids was completed. (See also PB 145 228)

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry and others. Final rept. for 1 June-31 Dec 57 on Contract DA 36-039-sc-72833. [1957] 41p. 3 refs. AD-200 872.
Order from LC mi$3.30, ph$7.80 PB 145 230

Experimental studies have been carried out on fully plated, flat, circular AT-cut piezoids to trace the curves of normalized frequency as a function of normalized diameter. These curves are shown for a part of the intermediate range of d/h, which lies between 20 and 50, and the Mindlin first order asymmetric curves from approximate theory for the same region are shown for comparison purposes. Features of agreement and disagreement are pointed out. Reference is made to similar plots and comparisons which appeared in the quarterly reports for the d/h region below 20. Methods of identifying modes are described and illustrated. Examples of precisely designed electrode shapes and orientations are shown. They are applied by a photographic method, using jigs for exact alignment. Measurements on mode series resonant resistance and amplitude are discussed. New instruments and fixtures were described for the experiments in mode analysis of very high precision in the range of very small crystal thickness, and for making very small and closely controlled changes in the diameter of thin plates. (Author) (See also PB 145 229)

[Mallory, P. R., and Co., Inc., [Indianapolis, Ind.]
DEVELOPMENT OF POWER SUPPLY PP-( )/GRC: AC POWER SUPPLY FOR STANDARDIZED SERIES OF FM RADIO SETS, by E. D. Aldred. Final rept. for 15 May 56-15 May 57 on Contract DA 36-039-sc-72315. [1957] 51p. 5 refs. AD-143 696.
Order from LC mi$3.60, ph$9.30 PB 145 475

The report presents circuits used in the power supply, discusses the operation of the circuits and the power supply as a whole, and gives results obtained in a series of laboratory tests on the completed supply. Regulation and filtering of several output voltages were important considerations. Regulation of voltages having wide load variations was provided by magnetic amplifier regulators. Silicon diodes were used to reduce rectifier heat loss and aging and to provide more efficient magnetic amplifier operation. By utilizing these two relatively new devices, the heat generated in the power supply has been greatly reduced and the maintenance free life should be greatly extended. It is anticipated that this power supply should have a maintenance free life of 5,000 to 10.000 hours when operated at full load under usual operating conditions. (Author)

Melpar, Inc., Falls Church, Va.
AN ELECTROMECHANICALLY SCANNABLE TROUGH WAVEGUIDE ANTENNA, by H. H. Hibbs. Final rept. on Contract AF 19(604)4056. 1 Oct 59, 47p. 16 refs. AFCRC-TR-59-358.
Order from LC mi$3.30, ph$7.80 PB 145 559

The feasibility of electromechanically scanning a trough waveguide array has been demonstrated. The antenna consists of a trough waveguide array feeding a parabolic cylinder reflector. The trough waveguide is made to radiate by the use of periodic asymmetric base blocks. The array is scanned by mechanically changing the height of periodic structures located in the trough waveguide on the center fin. A total scan angle in excess of 20 degrees has been achieved with a beamwidth in the plane of scan equal to 3 degrees. A beamwidth of 10 degrees is obtained in the plane perpendicular to the plane of scan.

Michigan U. [Research Inst.] Ann Arbor.
REFLECTIONS IN A FERRITE FILLED WAVEGUIDE, by C. B. Sharpe and D. S. Heim. Technical rept. no. 72 on Contract DA 36-039-sc-63203. May 57, 27p. 6 refs. 2262-157-T; AD-141 658.
Order from LC mi$2.70, ph$4.80 PB 137 648

A solution is obtained for the electric field at the air-ferrite interface ($Z = 0$) in a rectangular waveguide filled with ferrite in the semi-infinite half ($Z > 0$) magnetized in the direction of the electric field. The field is expressed in terms of a Neumann series obtained by iteration of a singular integral equation which satisfies the boundary conditions at the interface. The equivalent circuit for the junction is also presented. (Author)

Microwave Engineering Labs., Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Perry H. Vartanian. Quarterly progress rept. no. 1 (Scientific rept. no. 1) 10 June-9 Sep 58 on Contract AF 19(604)4071. 9 Oct 58, 20p. AFCRC-TN-58-396; AD-160 853.
Order from LC mi$2.40, ph$3.30 PB 137 990

The objective of the study program is to increase the amplifying bandwidth of the paramagnetic maser. This will be accomplished particularly through the use of slow-wave structures. The study is limited to the use of the single crystal, chromium doped sapphire, commonly called ruby, because of its chemical stability characteristics. A cavity maser using paramagnetic ruby has been built and operated at 2600 mc with a 10 kmc pump. Gains of 28 db with 100 kc bandwidth were measured. Studies of slow-wave structures for a traveling-wave maser have been started and the required characteristics formulated. (Author)

Microwave Engineering Labs., Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts. Quarterly progress rept. (Scientific) no. 5, 10 June-9 Sep 59, on Contract AF 19(604)4071. 9 Oct 59, 41p. 18 refs. AFCRC-TN-59-799.
Order from LC mi$3.30, ph$7.80 PB 145 548

The objectives of the study program are to investigate means of increasing the amplifying bandwidth of the solid state maser, particularly by means of slow-wave structures. In addition an initial survey will be made, involving no developmental work, of means to extend the maser to higher operating frequencies. (See also PB 143 973)

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH, by M. Chodorow. Scientific rept. no. 15 for 1 Apr-30 June 59 on Contract AF 19(604)1930. Sep 59, 18p. M. L. rept. no. 639; AFCRC-TN-59-756; AD-230 920.
Order from LC mi$2.40, ph$3.30 PB 145 574

Coupled cavity theory. Plasma physics studies. Nonlinear propagation in ferrite media. (See also PB 143 205)

Microwave Lab., Stanford U., Calif.
ON THE BOUNDARY VALUE PROBLEM OF WAVEGUIDE WINDOWS, by Max Paul Forrer. Technical rept. on Contracts Nonr-225(26, 48) and N6onr-25123. Mar 59, 123p. 15 refs. M. L. rept. no. 575; AD-215 820.
Order from LC mi$6.30, ph$10.80 PB 145 117

The mode conversion theory is generalized to the case of arbitrary dielectric obstacles, and applied to the problem of the vicinity of dielectric waveguide windows of general shape. Results are compared with experimental measurements to determine the validity of the approximate methods used. The mathematical method is that of a normal mode expansion of the electromagnetic fields. The contribution of individual waveguide modes to the total field may be determined by successive approximations. The theory is applied to several specific window geometries where a perturbation procedure is used, based on an expansion of the fields in powers of $(\epsilon - 1)$. The comparison between theory and experiment is done by way of the) reflection coefficient. First-order solutions are accurate for windows of low dielectric constant $(\epsilon < 4)$ and small length. Improvements obtainable by second-order approximation are illustrated. For windows of high dielectric constant $(\epsilon \approx 10)$ and a length of the order of a guide wavelength, there is strong modal interaction, so that the first-order solutions are only qualitatively correct. Accurate results for this case must be obtained by numerical integration of the coupled differential equations of several modes. This problem is well adapted to programming on a computer. The phenomenon of ghost-modes in dielectric windows is discussed. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
BROADBAND HIGH POWER COAXIAL LINE COUPLERS, by Stanley Greenblatt and John W. E. Griemsmann. Final rept. on Contract AF 30(602)1735. 4 Sep 58, 58p. 2 refs. Rept. R-689-58; PIB-617; RADC-TR-58-140; AD-148 960.
Order from LC mi$3.60, ph$9.30 PB 145 399

A hybrid (3 db) coaxial coupler fed from standard 1-5/8" line at 600 mc/sec. was designed, constructed, and a first model tested. The operating principle is similar to that of the "short-slot" coupler in rectangular waveguide and utilizes dielectric to achieve two modes of different phase velocity. Performance tests on the initial model indicate bandwidth and duplexing capabilities comparable to those of the waveguide "short-slot" coupler. An analysis was also made of a 3 db contra-directional coupler which requires no use of dielectric and for which greater bandwidths appear to be feasible both for the coupler and the associated duplexing network. In addition, a branched-guide type duplexer utilizing multiple interior T. R. tubes was analyzed. For the designs considered the bandwidth is less than that available for duplexers using the 3 db couplers. (Author)

National Bureau of Standards, Washington, D. C.
EXPENDABLE MODULES AS BASES FOR DISPOSAL-AT-FAILURE MAINTENANCE, by R. O. Stone, P. Meissner and K. M. Schwarz. Feb 60, 84p. 19 refs. Technical note no. 41.
Order from OTS $2.25 PB 151 400

This report compares the costs to procure, support and maintain an equipment designed with expendable modules to the costs to procure, support, and maintain a similar equipment designed with repairable modules. It was found that the total costs in either case were approximately equal. Modules of various electrical sizes (from 1 to 12 tubes) have been compared from the standpoint of total over-all procurement cost, in order to determine an optimum module size. On the basis of calculations made, it has been concluded that the optimum module which would lead to lowest over-all procurement cost and at the same time be of aid in the solution of logistic and maintenance problems would be one containing from 4 to 8 tubes. This is true for both disposal-at-failure and repairable modules.

Naval Ordnance Test Station, China Lake, Calif.
THE NOTS PCM TIMING SYSTEM: AN OVERALL DESCRIPTION, by J. B. Moffett. 26 Aug 59, 67p. 17 refs. NOTS TP-2316.
Order from LC mi$3.90, ph$10.80 PB 145 382

The underlying principle of the PCM timing system is pulse transmission of data; precise timing and control functions are derived by digital techniques and sent to test-range instrument sites via a 9-channel pulse-code-modulated UHF radio link. This report, one of a series on the entire timing system, is an introduction to the system as a whole. (Author)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 1, 1 Feb-30 Arp 53, on Contract DA 36-039-sc-42670. [1953] 21p.
Order from LC mi$2.70, ph$4.80 PB 145 194

Design of a new constant temperature oven and a review of pertinent literature, including ten quarterly progress reports.

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 9, 1 Feb-30 Apr 55, on Contract DA 36-039-sc-42670. [1955] 171p.
Order from LC mi$8.10, ph$27.30 PB 145 202

The optimum process employed included semi-polished quartz plates, no ion bombardment, etching at .04F^2, bakelite silver cement BC-6035, vacuum bake 1 hour at 150°C, Nalco #14 flux, no frequency adjustment spots, helium gas, preaging for 24 hours at 125°C. Much attention has been given to the derivation and application of an "aging prediction formula". (See also PB 145 201)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Final rept. for 1 Feb 53-31 July 55 on Contract DA 36-039-sc-42670. [1955] 227p.
Order from LC mi$9.90, ph$34.80 PB 145 203

Review of the project covering a period of 30 months. The standard metal HC-6/U holder itself can be the source of serious negative frequency deviations. Every unit must be hermetically sealed. Quartz plates above about 5 Mc should be polished, or at least semi-polished, and only lightly etched. There must be no trace of moisture or other contamination on the quartz plate surfaces during the plating, either by sputtering or evaporation. These crystal units should be charged to atmospheric pressure with a gas such as helium, which lends itself to effective leak tests by means of a mass spectrometer. The use of frequency adjustment spots over a base plating may cause high unit resistance at overtone frequencies. All crystal units should be pre-aged by a baking cycle, 24 hours at 125°C. Adequately fabricated crystal units should show no measurable effect from the standard humidity test or altitude test. An indication of crystal unit aging properties may be obtained by submitting test units to 5 full days at +75°C and measuring the total frequency variation. The above conclusions were the result of testing 492 crystal units for aging characteristics in constant temperature ovens maintained at 75°C to a stability of better than ±0.01°C. (See also PB' 145 202)

Radio Corp. of America, Harrison, N. J.
EVALUATION TESTS OF CERAMIC PENCIL TRIODE RCA DEVELOPMENTAL TYPE A15054Q, by J. J. Thompson and T. J. Henry. Final rept. for 10 June 57-10 June 58 on Contract DA 36-039-sc-74811. 10 July 58, 76p. 1 ref.
Order from LC mi$4.50, ph$12.30 PB 145 235

Evaluation data on one hundred tubes for electrical and mechanical tests and life are presented in the form of graphs and tables. The methods of test and conditions used are given for each test. Data on power gain and noise factor at 500 and 1000 megacycles are given; and the methods, conditions, and circuits used are discussed in detail with block diagrams and drawings. Results of input-admittance measurements at 500 Mc are shown in tables and graphs. Vibration data are reported in chart form, and results of shock and bending tests are given. Life test results at 175°C ambient temperature for 500 hours are shown in tables and graphs. A specification in Military Form for the A15054Q is presented and discussed. (Author)

Raytheon Mfg. Co., Waltham, Mass.
CERAMIC-METAL SEAL OUTGASSING STUDY, by R. J. Dyer and M. Weiss. QK608 Final rept. for 1 Apr-31 Dec 56 on Contract AF 19(604)1826. [1957] 37p. AFCRC-TR-57-162; AD-117 021.
Order from LC mi$3.00, ph$6.30 PB 145 438

A study was made of gases evolved from Raytheon ceramic-metal seal assemblies at temperatures up to 700°C for test assemblies brazed with the following solders: silver-copper eutectic, 80% gold - 20% copper, pure silver and pure copper. The gases evolved were hydrogen, carbon monoxide, water vapor and carbon dioxide. The quantities and kinds of gases produced during bakeout of the test assemblies apparently did not depend on the type of solder used.

RCA Service Co., Camden, N. J.
THE PREDICTION AND MEASUREMENT OF AIR FORCE GROUND ELECTRONIC EQUIPMENT RELIABILITY. Final engineering rept. on Contract AF 30(602)1623. 15 Aug 58, 179p. 9 refs. R-2-58; RADC-TN-58-307; AD-148 977.
Order from LC mi$8.10, ph$27.30 PB 145 924

A method was developed for reliability prediction in advance of equipment production. The objective was approached through a 3-phase study of representative equipments in 3 broad classes: radar, communications, and navigation. Results of the three-phases are briefly summarized. The predictions provided estimates of equipment mean-time-to-failure that agreed reasonably well with both laboratory tests and field observations. The predictions of failure contribution by major part classes proved accurate, within the statistical limits imposed by the amount of data, for 7 out of 10 part classes. The largest difference between obtained and predicted failures was in the tube category. Electrical, electronic, and electromechanical parts and components accounted for 98% of the true equipment failures used to estimate field reliability.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
AN ANALOG PROBABILITY DENSITY ANALYZER, by Hugh E. White. Master's thesis. Rept. on Contract DA 36-039-sc-64637. 29 Apr 57, 30p. 16 refs. Technical rept. 326; AD-156 601.
Order from LC mi$2.70, ph$4.80 PB 145 268

The development and construction of an analog analyzer for determining the first-order probability density function of signal amplitudes of frequencies between 30 cps and 20 kc is described. Values of probability density are determined by averaging a derived random variable that is unity when the signal

is in the amplitude interval that is being analyzed and is zero at all other times. It is generated by a diode level-selector circuit that gates a 60-mc carrier to a bandpass amplifier. This level selector eliminates many of the problems of frequency response and drift that are associated with the amplitude discriminators of the conventional level selector. The amplitude range of the signal comprises 50 intervals that are analyzed sequentially and the complete probability density function is plotted by a pen recorder. The frequency response and drift stability of the analyzer are experimentally evaluated, and examples of experimental probability density functions are given. Block diagrams and descriptions of both digital and analog systems that have been previously developed for determining probability density functions are presented. Definitions and some properties of probability density functions are reviewed. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
A THEORY OF SIGNALS, by Robert E. Wernikoff. Rept. on Contract DA 36-039-sc-64637. 31 Jan 58, 103p. 32 refs. Technical rept. 331; AD-158 737.
Order from LC mi$5.70, ph$16.80 PB 145 265

An experiment is presented in which an attempt is made to arrive at a mathematical description of physical signals that embodies, more realistically than the usual functional representation, our limitations in performing measurements. The object is to achieve a closer relation between the structure of the mathematical description and the finite-resolution properties of the detector that characterizes any real measurement process. An algebra of signals is obtained, appropriate to the model in which essentially frequency-limited signals interact with linear, time-invariant systems, and observations are made by means of a linear, finite-resolution oscilloscope. The properties of this algebra are studied, and a metric that indicates which operators give physically indistinguishable outputs is defined. The algebra is used to study problems in uniform and nonuniform sampling, the discrimination of two events from one in noisy, radar-like systems, and the conditions under which a signal is indistinguishable from its short-time average. A general procedure for linear, least-peak-error prediction is obtained. In the limit as the detector resolution becomes perfect, the present model is shown to tend smoothly to the usual functional model. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A PROPOSED TECHNIQUE FOR IMPROVING THE INTELLIGIBILITY OF VOICE RADIO TRANSMISSIONS IN THE PRESENCE OF AURORAL FLUTTER FADING, by O. G. Villard, Jr. and K. C. Yeh. Scientific rept. no. 3 on Contract AF 19(604)1830. 14 Oct 58, 13p. AFCRC-TN-58-644.
Order from LC mi$2.40, ph$3.30 PB 145 571

Stanford Research Inst., Menlo Park, Calif.
GROUND ILLUMINATION PATTERN OF SIGNALS REFLECTED FROM A METEOR TRAIL, by Edel M. Young and L. W. Yabroff. Scientific rept. no. 13 on Contract AF 19(604)1517. Dec 59, 82p. 3 refs. AFCRC-TN-59-997.
Order from LC mi$4.80, ph$13.80 PB 145 563

Given a transmitter location and arbitrarily oriented meteor trails, the ground-illumination pattern of the reflected signal is calculated. A physical model has been used, consisting of a trial of finite length and a radial distribution of electrons (forming a cylinder) according to Eshleman's theory. Equations are developed showing the reflection of a signal from a chosen trail to the earth's surface. Several graphs of calculated examples of ground illumination patterns are presented.

Stanford Research Inst., Menlo Park, Calif.
PROCEDURAL EFFICIENCY FOR INTERMITTENT COMMUNICATIONS SYSTEMS, by Bruce M. Sifford. Scientific rept. no. 14 on Contract 19(604)1517. Dec 59, 27p. 4 refs. AFCRC-TN-59-998.
Order from LC mi$2.70, ph$4.80 PB 145 564

Operational procedures are analyzed and formulas are derived for computing procedural efficiency of communication systems operating with an intermittent propagation mode and utilizing a feedback channel. Results show that an optimum transmission block length may exist which will maximize this efficiency. Some sample systems are evaluated and suggestions for possible improvements made. Systems where the feedback link operates on a parallel channel (dual-channel) are compared with a system where the feedback link time-shares the channel with the forward link (single-channel). Actual measured single distributions, obtained on the Bozeman-Palo Alto meteor-burst link, are used in the evaluations.

Stanford Research Inst., Menlo Park, Calif.
SYNTHESIS OF MODULATED CORRUGATED SURFACE-WAVE STRUCTURES, by J. T. Bolljahn. Scientific rept. no. 4 on Contract AF 19(604)3502. Nov 59, 22p. 3 refs. AFCRC-TN-59-973.
Order from LC mi$2.70, ph$4.80 PB 145 575

An exact procedure is described for the design of a surface that will support a prescribed group of surface waves simultaneously. The surfaces resulting from the application of this procedure are found to be modulated (i.e., to contain periodic waves in the direction of propagation) and to have surface impedance values that vary periodically in the direction of propagation. Finite-length surfaces of this type are hence reminiscent of Simon's "cigar antenna." Several surface designs are presented, and some general properties of the surfaces and the composite waves they support are discussed. Certain limitations on the design procedure are described.

Stanford Research Inst., Menlo Park, Calif.
A WIDE-BAND TRANSVERSE-SLOT FLUSH-MOUNTED ARRAY, by E. M. T. Jones and J. K. Shimizu. Scientific rept. no. 2 on Contract AF 19(604)3502. Sep 59, 27p. 6 refs. AFCRC-TN-59-975.
Order from LC mi$2.70, ph$4.80 PB 145 576

This report describes the design analysis and measured performance of an antenna composed of an H-plane array of parallel waveguides having quarter-wavelength-thick transverse slots extending completely across the array. Each relatively wide nonresonant slot in this array radiates only a small amount of power, and the dimensions of the slots are relatively uncritical. The radiated H field from this antenna lies parallel to the transverse slots. The cosine of the angle between the direction of maximum radiation and the plane of the antenna is equal to the velocity of light divided by the phase velocity of propagation along the array.

Tennessee U. Engineering Experiment Station, Knoxville.
AN ACOUSTIC ANALOG OF CIRCULAR ANTENNA ARRAYS, by T. A. Lewis and J. D. Tillman. Scientific rept. no. 3 on Contract AF 19(604)4967. 1 Dec 59, 52p. 21 refs. AFCRC-TN-59-996.
Order from LC mi$3.60, ph$9.30 PB 145 580

Contained in this report is the presentation of a method of experimentally investigating the radiation of these circular antenna arrays by means of an analogous acoustic array. The absence of appreciable mutual coupling between the elements of the acoustic analog array is shown to provide an advantageous simplification of the experimental investigation of the arrays, and is further shown to provide a means of studying the effects of an error in magnitude of excitation in a single element of the array. Experimental radiation patterns were taken for certain circular acoustic arrays, and their results were presented. The results indicate that the use of the acoustic analog was justified. (Author)

Transistor Applications, Inc., Boston, Mass.
RESEARCH DIRECTED TOWARD THE STUDY, ANALYSIS AND DESIGN OF TRANSISTOR CIRCUITS, by A. W. Carlson. Scientific rept. no. 2, Dec 58-Oct 59, on Contract AF 19(604)4089. Oct 59, 77p. 17 refs. AFCRC-TN-59-989.
Order from LC mi$4.50, ph$12.30 PB 145 283

This report is concerned with the investigation of the high current mode of transistor operation first described by Thornton and Simmons (A New High Current Mode of Transistor Operation, I. R. E. Transactions on Electron Devices Vol. ED-5, January 1958, pp. 6 - 10). It is concluded that this is an avalanche multiplication phenomenon which allows the collector voltage to become less than the open base breakdown voltage when operated with reverse base current. With large reverse base currents the injected emitter current is concentrated in the center in a transistor of radial symmetry to result in high current density. At high current density, minority carriers traversing the collector depletion region at terminal velocity increase the charge density to effectively lower the breakdown vo voltage. This concept and an approximate calculation of the injected emitter current density distribution enables sketching the transistor characteristics and explanation of other aspects of the phenomenon. (Author) (See also PB 139 422)

Navy Electronics Lab., San Diego, Calif.
AN AUTOMATIC START-STOP-PHASE UNIT FOR FACSIMILE RECORDERS, by J. R. Coates. 4 June 58, 5p. Research and Development rept. 849; AD-212 873.
Order from LC mi$1.80, ph$1.80 PB 145 351

A start-stop-phase device was developed, with simplified circuitry, for utilizing the signals transmitted on the National Weather Analysis Center facsimile line to permit automatic unattended operation of a facsimile recorder. The device was operated, part time, for several weeks in a type AN/FXH-3(XN-1) recorder without failure or malfunction. (Author)

Ohio State U. Research Foundation, Columbus.
PHYSICAL ELECTRONICS AT MILLIMETER WAVELENGTHS, by T. C. Pang and M. O. Thurston. Rept. on Research on Physical Phenomena Affecting the Characteristics of Electronic Components, Contract AF 33(616)5924. Dec 59, 17p. 3 refs. WADC Technical rept. 59-494.
Order from OTS $0.50 PB 161 493

Theoretical and experimental studies of possible new slow-wave structures for electron tubes are presented. The structures considered are formed on the surface of p-type silicon by means of solid state diffusion of an n-type impurity. The properties of these structures are dependent on the dc bias applied between the diffused structure and the bulk silicon. The techniques employed in producing intricate structures to close tolerances are discussed in detail. The results of cold tests are compared with the calculated behavior for simple geometries. An application of simple distributed structures in the measurement of the microwave properties of semiconductors is considered. Other side effects observed with distributed structures are also discussed. (Author)

Olin Mathieson Chemical Corp., New Haven, Conn.
INVESTIGATION ON MEANS OF IMPROVING THE PERFORMANCE AND MINIATURIZATION OF LECLANCHE BATTERIES, by Raymond I. Cowles and Richard C. Evans. Final rept. for 1 May 56-30 Apr 57 on Contract DA 36-039-sc-71241. 31 May 57, 35p. 6 refs. AD-137 911.
Order from LC mi$3.00, ph$6.30 PB 145 534

A miniature multiple-cell battery was developed with long-life characteristics. Consideration was given to the loss of moisture and penetration or perforation of the chemically inert film which serves as cathode and divider between cells. In the development of duplex electrodes, the use of Fassler film eliminated the

bulky conductive cloth as an inert cathode. This permitted an increase in size of the mix cake and therefore, an increase in capacity. Batteries made with Fassler or Pertrix Graphite film as the inert electrode showed no significant improvement over those made with conductive cloth on initial, 2- or 3-mo normal capacity tests, but showed marked improvement on 6-mo normal (high-drain) and 3-mo tropical tests. The control batteries were dead while those made with film had lost about half of their initial capacities. In comparing Fassler film with conductive cloth, potted batteries may show a more significant advantage over the conductive cloth since the factor of moisture loss will be eliminated. The use of 2.5% $(NH_4)_2Cr_2O_7$ as an inhibitor was superior to other concentrations of dichromate as well as to $HgCl_2$ after 6-mo normal storage. The potting technique was made more practical through the use of epoxy tubing.

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 8, 1 Nov 54-31 Jan 55, on Contract DA 36-039-sc-42670. [1955] 141p.
Order from LC mi$7.20, ph$22.80 PB 145 201

Many units tested employed indium bonding in place of cement. Such units show evidence of unstable frequencies and erratic resistance values; units having sputtered gold platings appear less stable than equivalent units with electrodes formed by evaporated gold. (See also PB 145 200)

Radio Corp. of America, Lancaster, Pa.
ELECTRON TUBE MATERIALS, GASES, AND GETTERS, by J. C. Turnbull. Quarterly progress rept. no. 1, 15 Oct 58-15 Jan 59, on Contract DA 36-039-sc-78226. 15 Feb 59, 33p. 5 refs.
Order from LC mi$3.00, pb$6.30 PB 145 237

Mass spectrometric equipment for determining the outgassing of metals such as nickel and iron after initial high temperature degassing at temperatures as low as 600°C. Early work indicates the possibility that diffusion is the limiting process in the evolution of gases from nickel and iron at lower temperatures.

Thomas, A. S., Inc., Cambridge, Mass.
STUDY OF GAIN LIMITATIONS AND PATTERN SYNTHESIS OF TRAVELING WAVE ANTENNAS, by A. S. Thomas. Final rept. M 56-1 on Contract AF 19(604)1714. 30 Nov 58, 100p. 13 refs. AFCRC-TR-58-198; AD-206 651.
Order from LC mi$5.40, ph$15.30 PB 138 262

Phase and/or amplitude modulation resulting in a spatial spectrum of $\sin\xi/\xi$ distributions has been investigated. The phase is considered as a Fourier series with each sine or cosine term of the series giving an infinite but rapidly converging series of $\sin\xi/\xi$ distributions. Each $\sin\xi/\xi$ distribution is due to a relative wavenumber in the spectrum where the relative wavenumber (δ) is defined so that $\delta>1$ is the slow wave region. Distributions of δ_i, the instantaneous relative wavenumber along the array, giving high gain endfire arrays have been obtained and fall into three classes: (1) Input to end tapers; - the relative wavenumber is high at the input and approximately one at the end of the array; (2) Ends to center tapers; - the relative wavenumber is high at the ends and approximately one at the center; and (3) Periodic tapers; - the relative wavenumber decreases to approximately one and then increases, decreases, etc.

Westinghouse Electric Corp., Baltimore, Md.
PULSE TRANSMISSION STUDY, by G. K. McAuliffe, R. Filipowsky, and E. I. Muehldorf. Final rept. on Contract AF 19(604)4082. June 59, 123p. 386 refs. AFCRC-TR-59-166.
Order from LC mi$6.30, ph$19.80 PB 145 569

The use of higher order alphabets for digital transmission is investigated. It is found that, for a practical system, higher order alphabets permit a more efficient approach than binary alphabets towards the maximum transmission rate. Electrical waveforms which are suitable for higher order alphabets were investigated. A set of four harmonic orthogonal waveforms is given. These waveforms are composed of sine and cosine components. The signal space occupancy for these waveforms was investigated in the low pass band and the carrier band. A most general waveform is one which is modulated in amplitude and frequency, here called FAM-waveform.

Ordnance, Missiles, and Satellite Vehicles

Air Force Missile Test Center, Patrick AFB, Fla.
ASKANIA CINE-THEODOLITE ACCURACY STUDIES CONDUCTED UNDER OD-039, by Jerome L. Sibol. Rept. on Missile Test Project, Contract AF 08(606)1156. 11 Sep 59, 33p. 2 refs. RCA Data Processing Technical rept. 52; AFMTC-TR-59-21.
Order from LC mi$3.00, ph$6.30 PB 145 551

A field test designed to determine Cine-theodolite accuracies is outlined. The mathematics of two methods of calibrating Cine-theodolites from these field test data are presented, and a comparison of the two calibration techniques is made by using Ballistic Camera data as a comparison standard. The results of several comparison studies are listed. Recommendations are made based on the results of the tests. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
A GENERAL LEAST SQUARES ADJUSTMENT FOR COMPUTING BALLISTIC MISSILE ATTITUDE, by George H. Rosenfield. Rept. on Missile Test Project, Contract AF 08(606)3413. Sep 59, 83p. 15 refs. RCA Data Processing Technical rept. no. 53; AFMTC-TR-59-22.
Order from LC mi$4.80, ph$13.80 PB 145 562

A rigorous least squares adjustment is presented for computing the three elements of ballistic missile attitude: pitch, yaw, and roll, utilizing images recorded by one or more photogrammetric cameras. The solution directly computes absolute attitude using a missile image exposed on a single photographic frame. Camera orientation, coordinates of selected points on the missile, and film measurements are required in the reduction. A minimum of three points are required for a solution from one camera. An outline of the computational program and a numerical example is presented to facilitate programming for electronic computation. The general computations are also specialized for computing roll from one camera; and pitch and yaw from two cameras. Application of the procedure to attitude reduction from both fixed and tracking cameras is also presented. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
REAL TIME DATA HANDLING SYSTEM FOR THE EXTENDED ATLANTIC MISSILE RANGE, by Jerome P. Keuper and A. -E. Hoffmann-Heyden. Oct 58, 81p. RCA Quality Analysis TN no. 29; AFMTC-TN-58-14; AD-207 350.
Order from LC mi$4.80, ph$13.80 PB 145 736

This report attempts to answer certain questions raised by RCA-MTP Target Acquisition and Display Engineering in regard to the design of a real-time data handling system. These questions are primarily concerned with the FPS-16 radars and their proposed associated computers. No attempt has been made to design or set forth a technical exhibit for the computers. It is expected, however, that the information contained in this report will considerably support this end. (Author)

Antenna Systems Lab., U. of New Hampshire, Durham.
PARAMETRIC AMPLIFICATION TECHNIQUES FOR USE IN SATELLITE TRACKING SYSTEMS, by Albert D. Frost and Donald W. Melvin. Scientific rept. no. 2 on Contract AF 19(604)3892. 1 Nov 59, 21p. AFCRC-TN-976.
Order from LC mi$2.70, ph$4.80 PB 145 284

In an effort to improve the reception of low level radio frequency signals encountered in satellite and space vehicle tracking, work has been carried out on the investigation and development of a number of specialized forms of parametric amplifiers. Units described in this report together with preliminary design and performance characteristics include a strip circuit adaptation of the resonant quarter-wave form of amplifier and an antenna-amplifier in which the resonant elements are integrated within a half-wave dipole antenna. (Author)

Army [Rocket and Guided] Missile Agency [Redstone Arsenal] Ala.
THE EFFECTS OF VARIATIONS OF NOSE CONE BLUNTNESS ON THE TURBULENT HEAT TRANSFER TO THE CONICAL PORTION OF A SPHERICAL-NOSED CONE, by Robert R. Fisher and Charles C. Wood. 20 May 58, 25p. 4 refs. Rept. no. DSD-TR-3-58; AD-200 004.
Order from LC mi$2.70, ph$4.80 PB 145 494

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPERIMENTAL FIRINGS IN AN ARGON-SULFUR-HEXAFLUORIDE MIXTURE OF VARIABLE GAMMA – DRAG CHARACTERISTICS AND SHOCK WAVE ANGLES OF 30° AND 70° CONE CYLINDERS FIRED IN A-SF_6 MIXTURES OF $\gamma = 1.4$ AND $\gamma = 1.17$, by M. R. Lewis and D. B. Sleator. Nov 57, 29p. 10 refs. Memo rept. no. 1047; AD-155 135.
Order from LC mi$2.70, ph$4.80 PB 145 658

This mixture has been used to simulate air in the study of the drag characteristics of projectiles. These two gases may be proportioned to have any desired value of γ from 1.10 to 1.67. Physical and thermodynamic properties of these mixtures are given.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INSTRUMENTATION FOR TRACKING SATELLITE IONOSPHERIC PAYLOADS. July 1959, 21p. Technical note no. 1267.
Order from LC mi$2.70, ph$4.80 PB 146 004

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ORBIT MEASUREMENTS OF AN ARTIFICIAL EARTH SATELLITE (SPUTNIK II) FROM PHOTOGRAPHS TAKEN WITH A TRACKING BALLISTIC TELESCOPE SYSTEM, by Dirk Reuyl. Nov 57, 16p. 9 refs. Technical note no. 1156.
Order from LC mi$2.40, ph$3.30 PB 146 076

A brief resume is given of optical methods for the measurement of artificial earth satellites. Observations of the third stage rocket of Sputnik I and Sputnik II with tracking ballistic telescope systems, based on SMT and IGOR instruments, are described. Measurements were made of Sputnik II records obtained with the SMT system during the dawn passage on 7 November, 1957. The accuracy of the resulting azimuth and elevation values is given by a mean error of about 10 seconds of arc for a single observation, or 4 seconds of arc for the weighted means of all observations. (Author)

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK: MASTER GRAPHS. Contract AF 04(647)59-3. [Apr 60] 16p.
Order from OTS $0.50 PB 161 093-3

See PB 161 093

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF A GREASEPROOF LINEAR FOR SPECIFICATION MIL-C-3955 FIBER CANS, by Howard M. Weiner. July 58, 8p. Technical rept. 2517; AD-201 208L.
Order from LC mi$1.80, ph$1.80 PB 145 450

Six materials and combinations of materials were evaluated in laboratory tests as possible replacements for the greaseproof lining material now used in Specification MIL-C-3955 fiber cans. Four of these materials (1, 2, 3, and 6) were judged to be satisfactory. Two of the four (1 and 2) were eliminated from the program because of difficulties anticipated in laminating them to fiber cans. Rolls of materials 3 and 6 were forwarded to the Ordnance Packaging Office Rossford Ordnance Depot, Toledo, Ohio, to be evaluated as liners for experimental fiber cans. (Author)

General Electric Co. [Schenectady, N. Y.]
AEROELASTIC EFFECTS ON HINGE MOMENT AND NORMAL FORCE OF THE FINS, by R. B. Chamberlin. 8 Jan 54, declassified 28 May 58. 4p. 2 refs. Hermes A-3B Aerodynamic Data Memo 21D.
Order from LC mi$1.80, ph$1.80 PB 145 427

This memorandum presents the change in the hinge moment and normal force coefficients due to aeroelastic effects. The incremental coefficients are to be added algebraically to the corresponding rigid-fin coefficients presented in A-3B Aerodynamic Data Memos #21B, 8B, and 8C.

General Electric Co. [Schenectady, N. Y.]
ANALYSIS OF STATIC STABILITY MARGIN OF HERMES A-3BE1, by Paul G. Cushman and Otto Klima, Jr. 20 Mar 53, declassified 28 May 58. 4p. 5 refs. Hermes A-3B Aerodynamic Data Memo no. 5C.
Order from LC mi$1.80, ph$1.80 PB 145 410

[General Electric Co., Schenectady, N. Y.]
ANALYSIS OF THE APPLICATION OF HEATERS TO THE PEROXIDE FLOW-CONTROL DRIVE MECHANISM, HA-3A, by Eric Johansson and William W. Fischer. 24 July 52, 2p. Hermes Heat Transfer Memo. no. 42.
Order from LC mi$1.80, ph$1.80 PB 145 469

Final temperatures attained for various heater powers are shown in Table I for four sets of conditions. Free and forced convection are considered as are two ambient temperatures. Experimental confirmation within 10% of the calculated values was obtained with the one set of conditions tested. For free convection the time constant (time required for case to reach 63% of final temperature) was 44 min., and for forced convection was 10 min.

General Electric Co. [Schenectady, N. Y.]
CENTER OF PRESSURE FOR COMBINED PITCH AND YAW ATTITUDE, by Helen C. Engvold and Robert B. Chamberlin. 1 May 53, declassified. 2p. Hermes A-3B Aerodynamic Data Memo. no. 14-H.
Order from LC mi$1.80, ph$1.80 PB 145 421

The effect of angle of attack in the pitch plane on center of pressure in the yaw plane for small side slip angles (less than 5°) is presented versus Mach number in the attached figure.

General Electric Co. [Schenectady, N. Y.]
COEFFICIENT OF HINGE MOMENT FOR ONE FIN AS A FUNCTION OF COMBINED ANGLES OF ATTACK AND SIDESLIP, SUBSONIC MACH NUMBERS, by Kathryn A. Parker. 8 Mar 54, declassified 28 May 58. 4p. Hermes A-3B Aerodynamic Data Memo no. 21F.
Order from LC mi$1.80, ph$1.80 PB 145 428

[General Electric Co., Schenectady, N. Y.]
A COMPARISON OF CALCULATED AND MEASURED NOZZLE TEMPERATURES FOR RUN #7 OF 31" DIAMETER MOTOR, by Allen E. Galson and William W. Fischer. 27 Aug 52, declassified 28 May 58. 9p. Hermes Heat Transfer Memo no. 33.
Order from LC mi$1.80, ph$1.80 PB 145 464

It is the object of this memorandum to compare test data obtained by means of thermocouples to transient temperature values calculated by a numerical method of analysis.

General Electric Co. [Schenectady, N. Y.]
COMPARISON OF EFFECTIVENESS OF PIPE-INSULATION WITHIN THE HA-3A MISSILE, by W. W. Fischer and Helen Bass. 21 May 53, 4p. Hermes Heat Transfer Memo. no. 24A, supplement to Memo. no. 24.
Order from LC mi$1.80, ph$1.80 PB 145 461

[General Electric Co., Schenectady, N. Y.]
COMPARISON OF TRANSIENT TEMPERATURE CALCULATION METHODS APPLIED TO UNCOOLED NOZZLES, by Bruch F. McClintic and W. W. Fischer. 19 Feb 52, 8p. Hermes Heat Transfer Memo. no. 25.
Order from LC mi$1.80, ph$1.80 PB 145 462

This memo presents methods of estimating transient temperatures at any axial or radial location in an uncooled convergent-divergent nozzle. The accuracy of various methods are compared and a suitable method selected for engineering use.

General Electric Co. [Schenectady, N. Y.]
COMPLETE MISSILE COEFFICIENTS OF NORMAL FORCE CENTER OF PRESSURE, by R. B. Chamberlin and Margaret A. Lavelle. 26 Dec 52, declassified. 5p. 2 refs. Hermes A-3B Aerodynamic Data Memo. no. 14D.
Order from LC mi$1.80, ph$1.80 PB 145 417

General Electric Co. [Schenectady, N. Y.]
DAMPING-IN-ROLL MOMENT, by Otto Klima, Jr. and Patricia A. Gill. 16 Mar 53, declassified. 2p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 28.
Order from LC mi$1.80, ph$1.80 PB 145 433

The attached figure presents the damping-in-roll moment as a function of Mach Number. The damping-in-roll moment is based on the calculation for the Hermes A-3AE1 and A-3AE2 (Aero. Data Memo. #35). Corrections were made to the "A" curves to account for the difference in fin size.

[General Electric Co., Schenectady, N. Y.]
DEVIATIONS FROM THE NOMINAL ANGLES IN SPACE DUE TO MANEUVERS AND WINDS DURING DESCENT FLIGHT, by Robert B. Chamberlin. 27 Aug 52, declassified. 2p. 2 refs. Hermes A-3B Aerodynamic Data Memo no. 24.
Order from LC mi$1.80, ph$1.80 PB 145 430

General Electric Co. [Schenectady, N. Y.]
DRAG AND AXIAL FORCE COEFFICIENTS, by Margaret A. Lavelle and Otto Klima, Jr. 2 Apr 53, declassified 2 Mar 54. 8p. 7 refs. Hermes A-3B Aerodynamic Data Memo. no. 3A.
Order from LC mi$1.80, ph$1.80 PB 145 409

The revision is (1) a change in configuration (the fin root shord is now 58" instead of 60"). (2) additional wind tunnel test data at M=1.72, 4.5 and 5.0. (3) NACA transonic free flight results of a one-fifth scale Hermes A-3A adjusted to be applicable to Hermes A-3B. (4) more recent methods for estimating base pressure drag. Calculations for this memorandum are in DFB #53-AO-655.

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF LARGE PITCH ANGLES IN STATIC STABILITY IN THE YAW PLANE FOR SMALL ANGLES OF SIDESLIP AT SUBSONIC MACH NUMBERS. 15 Jan 53, declassified. 3p. Hermes A-3B Aerodynamic Data Memo no. 14E.
Order from LC mi$1.80, ph$1.80 PB 145 418

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF PITCH ANGLES OF ATTACK ON CENTER OF PRESSURE IN THE YAW PLANE FOR SMALL SIDESLIP ANGLES AT MACH NUMBER 1.25, by R. B. Chamberlin. 18 May 53, declassified 3p. 1 ref. Hermes A-3B Aerodynamic Data Memo. no. 14G.
Order from LC mi$1.80, ph$1.80 PB 145 420

[General Electric Co., Schenectady, N. Y.]
EFFECTS OF PITCH ANGLES OF ATTACK ON CENTER OF PRESSURE IN THE YAW PLANE FOR SMALL SIDESLIP ANGLES AT MACH NUMBER 4.50, by Otto Klima, Jr. and Patricia A. Gill. 18 Mar 53, declassified. 3p. Hermes A-3B Aerodynamic Data Memo. no. 14F.
Order from LC mi$1.80, ph$1.80 PB 145 419

General Electric Co. [Schenectady, N. Y.]
ESTIMATED DIFFERENTIAL-PRESSURE DISTRIBUTION OVER FIN FOR MAXIMUM FIN LOADING CONDITION, by J. L. Diggins and R. B. Chamberlin. 21 Apr 53, declassified 28 May 58. 4p. 3 refs. Hermes A-3B Aerodynamic Data Memo no. 17.
Order from LC mi$1.80, ph$1.80 PB 145 423

[General Electric Co., Schenectady, N. Y.]
ESTIMATED LOAD DISTRIBUTION ON THE FIN, by Robert B. Chamberlin. 12 Sep 52, declassified. 3p. Hermes A-3B Aerodynamic Data Memo no. 11C.
Order from LC mi$1.80, ph$1.80 PB 145 415

[General Electric Co., Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE BEHAVIOR OF THE NOSE COMPARTMENT HA-3B MISSILE, by R. G. Fraser and William W. Fischer. 21 July 52, declassified 5p. Hermes Heat Transfer Memo. no. 36.
Order from LC mi$1.80, ph$1.80 PB 145 466

The temperatures prevailing within the nose compartment are shown in Figure 1. These temperatures were computed for a missile erected at W. S. P. G. on a clear summer day with essentially no wind.

[General Electric Co., Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE BEHAVIOR OF TAIL SECTION HA-3A, ROUNDS 1-8, PRE-LAUNCH TESTING, by Douglas J. Van Vranken and William W. Fischer. 27 Aug 52, declassified. 7p. Proj. Hermes Heat Transfer Memo. no. 39.
Order from LC mi$1.80, ph$1.80 PB 145 468

General Electric Co., [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE VARIATION OF THE LUBRICATING OIL STORAGE SYSTEM, HA-3A, by William W. Fischer. 23 July 52, 8p. Hermes Heat Transfer Memo. no. 35.
Order from LC mi$1.80, ph$1.80 PB 145 465

It is the object of this memorandum to estimate how rapidly the HA-3A missile lubricating oil changes temperature under typical pre-launch conditions. These data are desired since, 1) the viscosity of the "Foreshot Fluorolube" varies greatly with temperature especially below 50° F and 2) the flow metering device is an orifice. Therefore only small temperature changes are tolerable within the limits of accuracy desired in the oil flow rate.

[General Electric Co., Schenectady, N. Y.]
EXPERIMENTAL SUBSONIC STABILITY AND TRIM CHARACTERISTICS OF A CONFIGURATION WITH CLIPPED DELTA FINS AND TRAILING-EDGE-BAR CONTROLS, by Harold L. Bloom. 21 May 53, declassified 28 May 58. 11p. 4 refs. Hermes Aerodynamic Research and Development Data Memo. no. 4.
Order from LC mi$2.40, ph$3.30 PB 145 459

Subsonic wind-tunnel tests were carried out on model $N_{50}T_{58}$ with various deflections of the trailing-edge-bar controls, and on the body alone. This model may be considered as a possible eventual alternate configuration for the Hermes A-3. The results reported in this memo merely extend the speed range at which aerodynamic data are available.

General Electric Co. [Schenectady, N. Y.]
EXPERIMENTAL SUBSONIC TRAILING EDGE BAR CONTROL FORCE, by H. L. Bloom. 8 Apr 53, declassified 28 May 58, 4p. 3 refs. Hermes Aerodynamic Research and Development Data Memo. no. 3.
Order from LC mi$1.80, ph$1.80 PB 145 458

[General Electric Co., Schenectady, N. Y.]
HA-3A LOX TANK PRESSURE AND LOX DISCHARGE FROM CUT-OFF TO IMPACT, by Eric Johansson and William W. Fischer. 6 Aug 52, declassified, 28 May 58. 8p. Hermes Heat Transfer Memo no. 37.
Order from LC mi$1.80, ph$1.80 PB 145 467

Results are presented in figures 1 and 2. Figure 1 gives weight of LOX remaining plotted against time of flight. Figure 2 gives absolute pressure and gauge pressure in LOX tank plotted against time of flight. At 87 seconds all but 0.34 cubic feet = 24 lbs. of LOX are vented. This 24 lbs. remains in the head of the tank and vent line throughout the flight.

General Electric Co. [Schenectady, N. Y.]
HINGE MOMENT, NORMAL FORCE, AND CENTER OF PRESSURE OF THE FINS EXCLUDING FIN EFFECT ON THE BODY, by Helen C. Engvold and Otto Klima, Jr. 27 Apr 53, declassified. 5p. 27 refs Hermes A-3B Aerodynamic Data Memo no. 21B.
Order from LC mi$1.80, ph$1.80 PB 145 425

[General Electric Co., Schenectady, N. Y.]
HINGE MOMENTS FOR PERIOD OF MAXIMUM MANEUVER DURING DESCENT PORTION OF FLIGHT, by Nancy Thomas and Otto Klima, Jr. 9 Sep 52, declassified. 6p. 2 refs. Hermes A-3B Aerodynamic Data Memo no. 21A.
Order from LC mi$1.80, ph$1.80 PB 145 424

The "most probable" hinge moment during the descent portion of any of the five trajectories for the A-3B will not exceed 450 foot pounds per fin. The "most extreme" values will not exceed 1050 foot pounds per fin. These are considerably less than the 1900 foot pounds per fin which is the value used in the design the fin control system. The effect of gusts has not been considered in this study.

General Electric Co. [Schenectady, N. Y.]
INDUCED ROLL DURING LAUNCHING ($\alpha_X = 90^o$, $\phi_v = 22\ 1/2^o$) by Margaret A. Lavelle and Otto Klima, Jr. 20 Apr 53, declassified. 2p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 15A.
Order from LC mi$1.80, ph$1.80 PB 145 422

The roll moment caused by the nonsymmetrical attitude of the fins to the wind as shown in the accompanying figure is calculated assuming fin I to be at an angle of attack of 22 $1/2^o$ and the resultant moment from the remaining fins to be zero. This appears to be a conservative assumption.

[General Electric Co., Schenectady, N. Y.]
MAXIMUM AIR LOAD AND ACCELERATIONS OF THE NOSE CONE, by Robert B. Chamberlin. 27 Aug 52, declassified. 2p. 3 refs. Hermes A-3B Aerodynamic Data Memo. no. 11B.
Order from LC mi$1.80, ph$1.80 PB 145 414

[General Electric Co., Schenectady, N. Y.]
MAXIMUM BODY LOADS AND TRIM LOADS, by R. B. Chamberlin. 21 July 52, declassified 28 May 58. 5p. 14 refs. Hermes A-3B Aerodynamic Data Memo. no. 11 A.
Order from LC mi$1.80, ph$1.80 PB 145 413

General Electric Co. [Schenectady, N. Y.]
MAXIMUM AIR LOADS AND ACCELERATIONS OF THE NOSE CONE, by Robert B. Chamberlin. 21 Jan 53, 2p. 4 refs. Hermes A-3B Aerodynamic Data Memo no. 11D.
Order from LC mi$1.80, ph$1.80 PB 145 416

[General Electric Co., Schenectady, N. Y.]
MINIMUM STATIC STABILITY MARGIN OF THE HERMES A-3B (XSSM-A-16), by R. H. Norris. 11 Aug 52, declassified 28 May 58, 6p. 8 refs. Hermes A-3B Aerodynamic Data Memo. no. 5B.
Order from LC mi$1.80, ph$1.80 PB 145 411

This memorandum supersedes A-3B Aero. Spec. Memo #5A. It differs from that memo mainly by showing the effect of the considerable increase in the allowance for elastic effect. This allowance has now been calculated whereas previously it was merely a tentative proposal.

[General Electric Co., Schenectady, N. Y.]
PREDICTION OF TRANSIENT SKIN TEMPERATURE OF NOSE CONE (STATIONS 10 AND 25) by E. Giles and W. W. Fischer. 5 Sep 52, declassified 28 May 58, 3p. Hermes A-3B Aerodynamic Data Memo no. 26.
Order from LC mi$1.80, ph$1.80 PB 145 432

The object is to make available the necessary skin temperature information needed to design the HA-3B missile nose cone. Metal skin temperature as well as an indication of the surface temperature of a flush insulator are determined.

[General Electric Co., Schenectady, N. Y.]
PRESSURE DISTRIBUTION OVER THE CONICAL SECTION OF THE HERMES A-3B NOSE, by Nancy Thomas and Otto Klima, Jr. 29 July 52, declassified. 2p. 5 refs. Hermes A-3B Aerodynamic Data Memo no. 25.
Order from LC mi$1.80, ph$1.80 PB 145 431

General Electric Co. [Schenectady, N. Y.]
REVISION OF NORMAL FORCE COEFFICIENTS FOR 58" FINS INCLUDING THE FIN EFFECT ON THE BODY, by Robert B. Chamberlin and Helen C. Engvold. 9 Apr 53, declassified. 2p. 2 refs. Hermes A-3B Aerodynamic Data Memo no. 8C.
Order from LC mi$1.80, ph$1.80 PB 145 412

This memorandum supersedes the subsonic and transonic data for ^{d}CN presented in figure I of Aero. Data Memo. #8B.

General Electric Co. [Schenectady, N. Y.]
ROLL MOMENT CAUSED BY NON-SYMMETRICAL ATTITUDE AND BY RUDDER DEFLECTION, by Margaret A. Lavelle and Otto Klima, Jr. 3 Apr 53, declassified. 7p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 29.
Order from LC mi$1.80, ph$1.80 PB 145 434

[General Electric Co., Schenectady, N. Y.]
SELECTION OF HEAT TRANSFER COEFFICIENT FOR HA-2 NOZZLE, by Bruce F. McClintic and W. W. Fischer. 5 Mar 52, declassified 28 May 58. 8p. 10 refs. Hermes Heat Transfer Memo. no. 26.
Order from LC mi$1.80, ph$1.80 PB 145 463

General Electric Co. [Schenectady, N. Y.]
STABILITY AND TRIM CHARACTERISTICS FOR SEVERAL CONFIGURATIONS OF COMPLETE MISSILES, by Harold L. Bloom. 27 Feb 53, declassified 28 May 58, 20p. 11 refs. Hermes Aerodynamic Research and Development Data Memo no. 2.
Order from LC mi$2.40, ph$3.30 PB 145 457

This memo presents the calculated supersonic stability and trim characteristics for three highly swept delta-fin configurations utilizing the "bar" type of aerodynamic control.

General Electric Co. [Schenectady, N. Y.]
SUPERSONIC TRAILING-EDGE-BAR CONTROL FORCE, by John O. Powers. 26 Dec 52, declassified. 4p. Hermes Aerodynamic Research and Development Data Memo. no. 1.
Order from LC mi$1.80, ph$1.80 PB 145 456

This memorandum deals with the control force attainable through the use of trailing-edge-bar controls. The control forces presented herein are to be used primarily for the computation of missile maneuvering characteristics.

[General Electric Co., Schenectady, N. Y.]
TEMPERATURE TEST OF RANGE AND AZIMUTH UNIT, HA-3A, by Glen E. McIntosh. 7 Aug 52, 2p. Hermes Heat Transfer Memo. no. 43.
Order from LC mi$1.80, ph$1.80 PB 145 470

[General Electric Co., Schenectady, N. Y.]
TRAJECTORY CORRECTION CAPABILITIES DURING DESCENT FLIGHT, by Robert B. Chamberlin. 27 June 52, declassified 28 May 58. 6p. 4 refs. Hermes A-3B Aerodynamic Data Memo no. 22.
Order from LC mi$1.80, ph$1.80 PB 145 429

General Electric Co. [Schenectady, N. Y.]
WIND TUNNEL TEST RESULTS OF SEVERAL MISSILE CONFIGURATIONS, by Harold L. Bloom. 28 Jan 54, declassified 28 May 58. 51p. 10 refs. Hermes Aerodynamic Research and Development Data Memo. no. 5.
Order from LC mi$3.60, ph$9.30 PB 145 460

This memorandum summarizes the results of further wind-tunnel tests on missile configurations embodying highly swept fins and/or trailing-edge-bar controls. The wind tunnel tests were conducted originally under a Hermes A-3-configuration development study. The purpose of the later tests discussed herein is to extend the amount of information on trailing-edge-bar controls and highly swept fins to additional Mach numbers and variously shaped wing, body, and control configurations.

General Electric Co. [Schenectady, N. Y.]
WIND VELOCITY REQUIRED TO OVERTURN HERMES A-3B ON LAUNCHING STAND, by Patricia A. Gill and Otto Klima, Jr. 15 May 53, declassified. 1p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 30.
Order from LC mi$1.80, ph$1.80 PB 145 407

Illinois U., Urbana.
A STUDY OF THE KINEMATICS OF BUOYANT-BODY WATER EXIT, by M. E. Clark and J. M. Robertson. Rept. on Contract Nonr-1834(10). Apr 59, 86p. 13 refs. T. & A. M. Rept. no. 145.
Order from LC mi$4.80, ph$13.80 PB 145 376

The hydroballistics of buoyant prolate ellipsoids passing through a water-air interface has been studied. A kinematic, experimental approach has been used in this study due to the inherent difficulties of theoretical analysis and of dynamic measurements. An elementary momentum analysis is shown to predict significant velocity changes associated with the added mass and density of the exiting body. Further analytical consideration of free surface occurrences suggests the significance of the Froude number in characterizing the behavior.

Institute for System Research, U. of Chicago, Ill.
THE COMBINED NON-LINEAR EFFECTS OF EARTH OBLATENESS AND ATMOSPHERIC DRAG ON A NEAR-EARTH SATELLITE, by Trinidad J. Jaramillo. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Oct 59, 111p. 38 refs. WADC TR-59-513.
Order from OTS $2.50 PB 161 494

Sets of equations are presented which may be used in calculating the positions of an earth satellite moving under the influence of an attracting oblate earth and air drag, assuming the air density to decrease exponentially with height. The six elements of the initial elliptical orbit are expressed in terms of the initial conditions at burnout point, and equations are derived for obtaining the errors induced in the elements by the errors inherent in the initial conditions. Because of oblateness and air drag, these six orbital elements are not constants, but vary with time.

Institute for System Research, U. of Chicago, Ill.
OPTIMUM RE-ENTRY INTO THE EARTH'S ATMOSPHERE BY USE OF A VARIABLE CONTROL FORCE, by Francis J. Marshall. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Oct 59, 136p. 83 refs. WADC TR-59-515.
Order from OTS $2.75 PB 161 495

The objective of this study is to obtain general design information for a vehicle performing the following task: The vehicle carrying cargo sensitive to both heat and deceleration is initially in orbit about the earth. The vehicle then descends through the atmosphere to the earth's surface at a preselected time and place in a recoverable or non-recoverable manner. A variable control force is available during the descent. The approach is a mathematical one based primarily, but not exclusively, on the Calculus of Variations. The end product is an optimum control force program implying an optimum trajectory or a feasibility statement. The mechanics of re-entry are examined and a compact list of design requirements is obtained.

Integrated Range Mission, White Sands Missile Range, N. Mex.
SATELLITE ACQUISITIONS AND REQUIREMENTS FOR OPTIMUM OPTICAL TRACKING, by Donald L. Grigsby. Mar 59, 36p. 3 refs. Special rept. no. 12.
Order from LC mi$3.00, ph$6.30 PB 146 234

Part I of this report gives a method of finding the satellite's location in its orbit, its time of arrival, altitude at this point, and angle of elevation from a tracking position; the latitude and longitude of the satellite subpoint; and its great circle distance and azimuth from this tracking position. From Part II it is possible to obtain the optimum times and locations of the satellite for optical tracking. Further work gives a method of effecting accuracy as well as obtaining orbital elements from raw data. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL AND MATHEMATICAL TECHNIQUES FOR DETERMINING THE DYNAMIC RESPONSE TO PRESSURE GAGES, by Chester G. Hylkema and Ralph B. Bowersox. Rept. on Contract DA 04-495-ORD-18. 6 Oct 53, 30p. 13 refs. Memo. no. 20-68.
Order from LC mi$2.70, ph$4.80 PB 145 921

The high-frequency limitations of pressure gages is of paramount importance in some measurements, particularly with unstable combustion of rocket motors. Because of the difficulty or impossibility of generating sinusoidal pressure variations at high pressures, the high-frequency response cannot be directly determined; in consequence, it is necessary to use aperiodic functions such as a unit step or pulse for test purposes. The advent of digital computers makes it feasible to translate the time responses to these aperiodic functions to their frequency-phase equivalent and thereby determine the frequency-phase characteristics of the pressure-measuring system. This translation involves the evaluation of the Fourier integral which evaluation can be carried out by a stepwise integration directly from the experimental time-response data. Some standard types of responses can be translated to frequency-phase equivalents more directly. The experimental equipment for generating pressure variations include a resonant-tube sinusoidal generator for low pressures, a burst-diaphragm step generator giving a rise time less than 1 millisec, a shock tube giving a rise time less than 100 microsec, and a closed bomb. (Author)

Naval Ordnance Lab., White Oak, Md.
ELECTRO-THERMAL EQUATIONS FOR ELECTRO-EXPLOSIVE DEVICES, by Louis A. Rosenthal. 15 Aug 59, 52p. 2 refs. NAVORD Rept. 6684.
Order from LC mi$3.60, ph$9.30 PB 145 628

A basic equation that relates the wire bridge temperature of an electro-explosive device to the applied power is introduced. Techniques for measuring the important thermal parameters are presented together with experimental observations. The equations which describe the temperature rise as a function of time for constant current, condenser discharge, and constant voltage firing are developed. (Author)

Naval Ordnance Test Station, China Lake, Calif.
ARMING AND FIRING DEVICE EX 16 MOD O FOR THE SUBROC FLIGHT-INTERRUPTER SYSTEM, by Jack Davidson. 6 Oct 59, 24p. NOTS TP-2336; NAVORD rept. 6601; AD 229 404.
Order from LC mi$2.70, ph$4.80 PB 145 126

The design, development, and test of an arming and firing device--a component of the command flight-interrupter system for the SUBROC missile--are reported. (Author)

Naval Ordnance Test Station, China Lake, Calif.
IMPACT. THERE'S MORE TO IT THAN MEETS THE EYE, by Marvin E. Backman. Nov 59, 9p. 3 refs. Technical Article 1; NOTS TP-2367.
Order from LC mi$1.80, ph$1.80 PB 145 626

The scientist can determine the penetration, vibration, and wave motions that occur during the event called "impact" even when high-speed photographic equipment is not available or is inadequate. By applying certain equations, it is possible for him to make calculations that are more precise than a photographic record of the event. (Author)

Naval Research Lab., Washington, D. C.
STELLAR MAGNITUDE OF LOW-REFLECTANCE SPHERICAL SATELLITES, by S. Neuder. Interim rept. 15 Feb 60, 8p. 4 refs. NRL rept. 5431.
Order from LC mi$1.80, ph$1.80 PB 143 940

Black finishes on orbiting satellites would have certain advantages from the standpoint of passive temperature control, but would make optical acquisition and tracking difficult. In order to evaluate the difficulty, a series of preliminary model studies has been carried out on black-finished spheres. Collimated light, with 1/2-degree divergence, illuminated the small-scale model, and the light reflected from the model was measured as a function of phase angle using a photomultiplier detector. The equivalent stellar magnitude of a similarly finished 20-inch sphere illuminated by sunlight, and viewed from a distance of 200 miles has been computed as a function of phase angle for a number of surfaces. The largest magnitudes (smallest intensities) were +9 to +10.3 for a soot-covered sphere. Other blacks yield magnitudes of between +8 and +9 for phase angles up to about 90 degrees. For larger angles there is a decrease of as much as 2.5 magnitudes. From additional measurements on both white-painted and black-finished spheres it was found that drilling holes into 40 percent of a sphere's surface increases the magnitude from about half a magnitude or less at small phase angles to 1.5 magnitudes or more at large angles. (Author)

Rodman Lab., Watertown Arsenal, Mass.
FEASIBILITY OF EMPLOYING COLD FORMED TUBES FOR RECOIL CYLINDER APPLICATIONS, by A. Ayvazian. Apr 59, 15p. 2 refs. Technical rept. no. RPL-31/8.
Order from LC mi$2.40, ph$3.30 PB 145 378

Mechanical properties, machining tests, and pressure tests revealed that cylinders produced by this special cold forming process can be utilized for recoil applications.

Solid Propellant Information Agency, Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
STATIC CALIBRATION OF PRESSURE AND FORCE GAGES. Rept. on Contract NOrd-7386. Aug 58, 32p. 7 refs. Practices Recommended by JANAF Solid Propellant Rocket Static Test Panel. AD-205 867.
Order from LC mi$3.00, ph$6.30 PB 145 584

This Recommended Practice deals only with apparatus for generating accurately-known static pressures and the application of this apparatus for the purpose of calibrating pressure transducers. Pressure range of interest is from 10 psig to 20,000 psig. Use of the Recommended Practice is to assure accuracies of 0.1% in static pressure calibration (accuracies approaching 0.01% are attainable but at greatly increased cost in equipment, skill, and care). It does not cover devices and procedures for determining output of various pressure transducers; this subject is so varied and broad that it cannot be included.

Watertown Arsenal Labs., Mass.
DYNAMIC RESPONSE OF A NONLINEAR SUSPENSION SYSTEM, by J. J. Connor, Jr. Dec 59, 26p. 2 refs. Technical rept. no. WAL TR 850/12.
Order from LC mi$2.70, ph$4.80 PB 145 089

An approximate analysis of the dynamic response of a nonlinear torsional suspension system resulting from a sinusoidal ground profile variation is carried out. This system is similar in configuration to one being considered for the Vigilante undercarriage. In the analysis, the actual structure is first idealized considerably in order to reduce the number of generalized coordinates. Then, Hamilton's Principle is applied to determine the nonlinear Equilibrium and Constraint Equations. An Electronic Differential Analyzer is employed to evalute the variations in response of the idealized system with wavelength of the ground contour and rigidity of the torsion bar. Because of the numerous simplifications, the results are not directly applicable to the actual structure. However, they can be utilized as a guide in the preliminary design of the rear wheel suspension system for the Vigilante undercarriage. (Author)

Westinghouse Electric Corp., Baltimore, Md.
TRAJECTORY PROBLEMS IN CISLUNAR SPACE. Technical note on Contract AF 49(638)490. 31 Dec 59, 44p. 5 refs. AFOSR-TN-59-1284; AD-230 878.
Order from LC mi$3.30, ph$7.80 PB 145 477

Sanitation and Safety Engineering

Armour Research Foundation, Chicago, Ill.
EVALUATION OF DEEP TUNNEL SHELTERS, by K. E. McKee and R. W. Sauer. Final rept. on Contract CD-SR-58-55. Nov 58, 96p. 46 refs.
Order from LC mi$5.40, ph$15.30 PB 145 971

This report contains the results of an evaluation to determine the vulnerability to nuclear detonations of deep tunnel shelter systems below major cities. The final presentation gives the combination of weapon yield and depth of tunnels associated with various levels of damage. The vulnerability is considered for both the proposed shelter system and for individual tunnels. Primarily, attention is given to the shelters proper, although some consideration is given to the entranceways and utilities. (Author)

Naval Research Lab., Washington, D. C.
EFFECTIVENESS OF WATER MISTS FOR PROTECTION FROM RADIANT HEAT IGNITION, by H. E. Moran, Jr. Final rept. 16 Feb 60, 17p. 6 refs. NRL rept. 5439.
Order from OTS $0.50 PB 161 106

Wood specimens were exposed to radiant heat in simulation of fire spread between structures. The heat was modified in some tests by the interposition of a screen of water mist. Measurements were made of the intensity of exposure (radiant heat flux at the wood), the time required for ignition, the ignition temperature of the wood, and the effectiveness of the screening mist. The tests indicated that about 0.0005 gallon of water per square foot of screened area can reduce the radiant heat flux by 10 percent; this protection can be increased by using a larger amount of water. Substantial protection can be provided with much less water than is required by conventional fire fighting methods. The relationship between time for ignition and radiant heat flux varied considerably in repeated tests. This variation was attributed to sensitiveness of ignition to small changes in environment as well as to nonuniformity in the wood specimens. It was estimated that the lowest radiant heat capable of causing ignition is slightly below 0.55 cal/cm^2-sec. Ignition temperature was found to decrease uniformly with decreasing heat flux until it reached a limiting value of approximately 265°C. A partly empirical formula was derived for estimating the attenuating properties of a mist from its drop size distribution and water content. (Author)

Ship Building

George Washington U., Washington, D. C.
AN EXAMINATION OF CRUISER USAGE DATA: PART 1, by Mina Haskind Gourary. Rept. on Logistics Research Project, Contract Nonr-761(05). Dec 58, 18p. 2 refs. Serial T-96/58.
Order from LC mi$2.40, ph$3.30 PB 145 281

In a previous report, the author investigated the distribution of demands for ships' parts for destroyers, and compared them with data for submarines obtained by other members of the Logistics Research Project. Both destroyers and submarines are ships without central storerooms. The results suggested that the present allowance list should be expanded in range and contracted in depth in order better to satisfy the demands.

George Washington U., Washington, D. C.
EVALUATION OF DATA FOR THE USS TIRU (SS 416) by J. S. Hamilton. Rept. on Logistics Research Project, Contract Nonr-761(05). 5 Feb 59, 82p. Serial T-98/59.
Order from LC mi$4.80, ph$13.80 PB 145 591

Naval Ordnance Test Station, China Lake, Calif.
DEVELOPMENT OF FILMLESS TECHNIQUE FOR RECORDING DEFECTS IN SHIP WELDS, by J. I. Bujés. Feb 57, 41p. 2 refs. Ship Structure Committee serial no. SSC-104.
Order from LC mi$3.30, ph$7.80 PB 137 557

Direct-reading or filmless technique in radiography using a 300 mC Cobalt-60 source and a Geiger counter as a detector on a 1-in. thick steel welded test plate. At present, the scintillator is the most useful detector of gamma radiation.

Washington U. [Seattle].
WELDED REINFORCEMENT OF OPENINGS IN STRUCTURAL STEEL MEMBERS, by D. Vasarhelyi and R. A. Hechtman. Progress rept. no. 1 on Contract NObs-50238. 15 Dec 51, 124p. 32 refs. Ship Structure Committee serial no. SSC-39.
Order from LC mi$6.30, ph$19.80 PB 137 556

The opening was many times as effective in decreasing the energy absorption of the plates as their ultimate strength. The energy absorption to failure varied from only 9 to 26 percent of the value for the plain plates. The best performance with respect to their strength and energy-absorbing capacity were those plates with circular openings or with square openings with rounded corners.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

American Meat Inst. Foundation, Chicago, Ill.
IMPROVING THE QUALITY OF FROZEN-DRIED STEAKS THROUGH APPLICATION OF PROTEOLYTIC ENZYMES, by C. Edith Weir. Rept. no. 12 (Final) 1 Apr 56-30 Oct 58, on Contract DA 19-129-qm-576. [1958] 27p. 3 refs. QFCIAF File no. A-321; AD-227 761.
Order from LC mi$2.70, ph$4.80 PB 145 762

A description and discussion are made of the effects of twelve proteolytic enzymes upon muscle fiber and connective tissue structure and panel evaluations for tenderness and amount of residue infrozen-dried raw beef. Enzymes from fungal and plant origin differed in activity, fungal amylase and Rhozyme P-11 affecting the muscle fibers and bromelin, ficin and papain attacking the collagen and elastic fibers as well. Similar studies were conducted on steaks, cooked, and enzyme treated and cooked, before freeze-drying. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
EMERGENCY FOOD VALUE OF ALASKAN WILD PLANTS, by Horace F. Drury and Stanley G. Smith. July 57, 49p. 7 refs. Technical note AAL-TN-57-16.
Order from LC mi$3.30, ph$7.80 PB 146 197

This report is directed not to the scientist, for whom it would be too incomplete, nor to the student, for whom it would be too detailed, but to the instructor who must know more than he will have to teach and yet who does not have the time to become a botanist. Additional information may be obtained from the Heller report, "Wild Edible and Poisonous Plants of Alaska," and from A. E. Porsild's "Edible Plants of the Arctic." Both of these publications contain drawings and much valuable information not included in this report.

Ohio State U. Research Foundation, Columbus, Ohio.
ION-PROTEIN INTERRELATIONSHIPS AFFECTING THE QUALITY OF DEHYDRATED MEAT, by M. K. Hamdy and Fred E. Deatherage. Rept. no. 12 (Final) for 1 June 56-31 May 58 on Contract DA 19-129-qm-613. [1958] 37p. 35 refs. QFCIAF File no. A-316.
Order from LC mi$3.00, ph$6.30 PB 145 764

Freeze-dehydration did not affect the pH of control or modified meat 2 and 15 days post-mortem. Fresh control and modified meat was characterized after freeze-drying using a plate temperature of 43°C and a chamber pressure of 1500μ Hg. When the meat was freeze-dried using a plate temperature of 22-30°C and pressure of 300-400μ Hg., the water-holding capacity was improved in the rehydrated modified meat and also the eating quality. Rehydration of previously modified freeze-dried meat in a solution containing 0.2 M NaCl, 0.01 M KCl and 0.05 M Na-ascorbate favorably affected flavor, texture, and water-holding properties. Cooking prior to freeze-dehydration adversely affected the final product. Irradiation of ham using a dose of 2×10^6 rep had no effect on pH, water, or T. C. A. soluble protein fractions, and on the calcium and magnesium in both the water extract and the juice released upon cooking. Water-holding properties of the ham, at various temperatures, were unfavorably affected by irradiation.

Quartermaster Corps, Washington, D. C.
COFFEE FOR THE ARMED FORCES: MILITARY DEVELOPMENT AND CONVERSION TO INDUSTRY SUPPLY, by Franz A. Koehler. 1958, 136p. QMC Historical Studies Series II, No. 5.
Order from LC mi$6.90, ph$21.30 PB 145 106

The monograph attempts to show how industry in 1955-56 succeeded in displacing the military roasting plants and in itself becoming the source of roasted-and-ground coffee supplied to the Armed Forces.

Wilson and Co., Inc., Chicago, Ill.
DEVELOPMENT OF FREEZE-DEHYDRATED PRE-COOKED BEEF PRODUCTS, by A. C. Edgar, J. S. Forsyth, and E. R. Packham. Rept. no. 6 (Final) for 28 Apr 57-30 June 58 on Contract DA 19-129-qm-845. [1958] 24p. QFCIAF File no. A-322.
Order from LC mi$2.70, ph$4.80 PB 145 763

The results of all previous reports are summarized. The development work which describes the ingredient specifications, formulae, and manufacturing instructions is outlined. Information dealing with the utilization of carcass and with the economics of the eight products developed is presented as the conclusion of the project. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Army Engineer Research and Development Labs., Fort Belvoir, Va.
AIRBORNE CRANE-EXCAVATOR, by James K. Knaell. Rept. for Mar-Sep 58. 27 July 59, 50p. Rept. 1589-TR; AD-228 121.
Order from LC mi$3.30, ph$7.80 PB 145 277

The structural and functional adequacy of the airborne (Airdroppable) crane-shovel and its ability to fulfill certain military characteristics was investigated. The airborne crane-shovel is a single-gasoline-engine-driven, pneumatic-tired, 4 x 4 drive machine that is full revolving and capable of craning, clamshell, dragline, and shovel operations. Lifting tests indicated that the airborne crane meets the 7-ton lifting-capacity requirement. Strain gage tests indicated structural elements are not over-stressed when maximum loads are lifted. All attachment changes except shovel front can be performed by 2 men with hand tools. The 3/8-cubic-yard buckets (Machinery, Fabrications and Accessory Equipment, are more suitable than the 1/2-cubic-yard size for military earthmoving operations. The rear outrigger box requires modification to prevent damage during shovel operation. A 2-speed transmission incorporating a low gear is required to enhance mobility. The unit can be towed cross country and at convoy speeds with a standard 2 1/2-ton, 6 x 6, Ordnance truck. Simulated air-drop tests indicated that chances for a successful airdrop are favorable. Self-propelled speed of 9.5 mph was considered the optimum safe travel speed.

Naval Civil Engineering Lab., Port Hueneme, Calif.
DEVELOPMENT OF THE RUSH ROLL, A MOBILE STRUCTURE USED AS A ROADWAY OR FLOATING PONTOON BRIDGE, by P. J. Rush. Final rept. 23 Nov 59, 41p. Technical rept. 046.
Order from LC mi$3.30, ph$7.80 PB 145 158

The Rush Roll is a mobile, 6-foot-diameter, segmented cylinder of corrugated steel pontoons weighing 6,000 pounds which can be towed by jeep. It unfolds into a four-trussed structure 13 1/2 feet wide and 17 1/2 feet long that can be rapidly joined with other rolls creating any length roadway or pontoon bridge, or outboard powered rafts. Results of field assembly, structural proof-loading and mobility experiments on land and sea are given. (Author)

Aerojet-General Corp., Azusa, Calif.
CHEMICAL FRAGMENTS AS ULTRA-ENERGY PROPELLANTS, by D. L. Wulff, Lillian H. Baum, and J. M. Fluornoy. Abstracts bulletin no. 4, Contract AF 18(603)110. Nov 59, 60p. 234 refs. Aerojet TN-33; AFOSR-TN-59-1249.
Order from LC mi$3.60, ph$9.30 PB 145 649

Investigations of certain high-energy chemical systems as potential propellants for rocket propulsion have necessitated an extensive review of the literature concerned with chemical fragments, embracing the related subjects of production, identification, stabilization, and determination of properties. The ultra-energy substances include charged (ions) and uncharged (free radicals) molecular fragments. It is the purpose of this bulletin to help make the information accumulated in the Aerojet-General file of reference abstracts generally available. (See also PB 133 987)

Avco Research Lab. [Everett, Mass.]
THE PRODUCTION OF HIGH TEMPERATURE GAS BY MAGNETIC ACCELERATION, by G. S. Janes and R. M. Patrick. Rept. on Contract AF 49(638)61. Mar 58, 15p. 1 ref. Research rept. 27; AFOSR-TN-58-439; AD-205 519.
Order from LC mi$2.40, ph$3.30 PB 137 579

A study was made of gaseous magnetohydrodynamics under conditions where the ions Larmor radius is of the order of a millimeter while the mean free path for collisions is larger, of the order of a centimeter. This requires a temperature of 10^{6}°K at particle densities of a few time 10^{16} per cc. Physical phenomena in this region are interesting for fusion power applications and have more recently exhibited possible applications in space flight propulsion. (Author)

James Forrestal Research Center, Princeton, N. J.
BASIC RESEARCH IN PHYSICAL AND CHEMICAL KINETICS RELATED TO PROBLEMS OF COMBUSTION AND PROPULSION, by R. H. Wilhelm. Final rept. on Contract AF 33(038)23976. 4 Nov 59, 18p. 28 refs. TR-59-174.
Order from LC mi$2.40, ph$3.30 PB 145 685

The program of work was as follows: (a) Studies of fast reactions utilizing presently known techniques as well as devising possible new ones. (b) Studies of reactions of hydrocarbons with N_2O_5 using vapor phase reaction between methane and N_2O_5. (c) Studies of decomposition of solid nitrates of amines and their reactions with NO_2. (d) Further studies of energy exchange in collision processes. (e) Studies of kinetics related to reactions of ozone with organic compounds. This will include use of liquid and high-concentration gaseous ozone. (f) Studies of flame stabilization giving consideration: (1) to flames with known kinetics beyond those already studied; (2) to investigation of effect of a surface of controlled temperature and composition on stability limits of flames.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMBUSTION STUDIES OF AMMONIA-OXYGEN ROCKET MOTORS USING A TEMPERATURE-MEASURING PROBE, by Dwight I. Baker. Rept on Contract NOas-52-455-C. 21 Oct 52, declassified. 48p. 9 refs. Progress rept. no. 24-1.
Order from LC mi$3.30, ph$7.80 PB 146 207

A probing method was developed so that radial temperature surveys could be made in rocket-motor combustion chambers. Temperature was determined pneumatically by bleeding combustion products through a water-cooled probe which contained two sonic-flow nozzles in series. Heat was extracted from the bled gas between the two nozzles. A simplified thermodynamic theory was employed to derive an expression for chamber temperature as a function of pressures upstream from the two nozzles, a probe constant, and temperature upstream from the downstream nozzle. Values of temperature as high as 5300°F (105% of theoretical) were determined for certain test conditions. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TEMPERATURE SURVEYS OF ROCKET-MOTOR COMBUSTION CHAMBERS, by Dwight I. Baker. Rept. on Contract NOas-52-466-C. 28 Nov 52, 26p. 3 refs. Progress rept. no. 24-5.
Order from LC mi$2.70, ph$4.80 PB 146 208

Surveys of temperature and local heat flux were made within NH_3-LO_2 rocket-motor combustion chambers using pneumatic double-sonic-nozzle probes. The temperature surveys were correlated with external measurements of specific impulse, good agreement being obtained for most tests. A modified temperature-measuring probe was developed for use with the gasoline--liquid oxygen propellant system. (Author)

Purdue U., Lafayette, Ind.
A REVIEW OF THE PUBLISHED LITERATURE PERTAINING TO THE ANNULAR, TWO-PHASE FLOW OF LIQUID AND GASEOUS MEDIA IN A PIPE, by D. A. Charvonia. Rept. on Contract Nonr-1858(25). Dec 58, 151p. 55 refs. Proj. Squid Technical rept. PUR-32-R.
Order from LC mi$7.50, ph$24.30 PB 145 067

Rocket Research Lab., Ohio State U. Research Foundation, Columbus.
RESEARCH ON COMBUSTION PHENOMENA AT HIGH PRESSURES, by Rudolph Edse, William A. Strauss, and Michael C. Fong. Rept. for 1 Jan-31 Dec 58 on Contract AF 33(616)5439. Jan 59, 29p. 11 refs. WADC Technical note 59-328.
Order from OTS $0.75 PB 161 480

The burning velocities of the ammonia-oxygen and the ammonia-air flames increase and decrease respectively as the pressure is increased from 1 to 14.0 atmospheres. The effect of ethyl nitrate on the burning velocity of gas mixtures is a function of the system to which the ethyl nitrate is added. When the nitrogen in rich ethylene-oxygen-nitrogen and acetylene-oxygen-nitrogen mixtures was replaced by carbon monoxide the burning velocity was increased.

Machine Parts and Mechanisms

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
A METHOD FOR THE SELECTION OF VALVES AND POWER PISTONS IN HYDRAULIC SERVOS, by Fletcher C. Paddison and Walter A. Good. Rept. on Contract NOrd-7386. Apr 54, 52p. 6 refs. CM-717A.
Order from LC mi$3.60, ph$9.30 PB 145 730

An analysis was made of hydraulic servo systems to determine a method of selecting transfer valves and power pistons that will give the optimum oil-pressure distribution within a servo. Two valve types were considered.

Naval Ordnance Test Station, China Lake, Calif.
THE NOISES OF TWO SPUR-GEAR TRANSMISSIONS, by M. Wm. Rosen. 27 July 59, 55p. NOTS TP-2293; NAVORD rept. 6569.
Order from OTS $1.50 PB 161 464

Two conventional but precision-quality planetary gear trains have been driven to 20,000 and 27,500-rpm speeds, with as much as 70 hp. Measurements were systematically made of the total acoustic energy radiated and also of the unit intensities over the frequency spectrum 0 to 30,000 cps. Total energies of up to 1/4 watt pure acoustic power were generated. Intense vibrations were radiated at frequencies corresponding with the tooth-mesh period. A law of acoustic energy was discovered for these two machines, a law which may possibly be valid for all gear trains.

Manufacturing Equipment and Processes

Budd Co., Philadelphia, Pa.
IMPROVED METHODS OF FABRICATING WELDED SANDWICH STRUCTURES: PILOT PRODUCTION LINE OPERATION AND WELD QUALITY CONTROL FOR BUDD INTEGRATED CORE PANELS, by J. E. Burton. Final rept. on Contract NOas-58-622c. 31 Oct 59, 230p.
Order from LC mi$9.90, ph$34.80 PB 145 366

A 'SUMMARY' chart of manhours required to fabricate Integrated Core Panels. Pilot line fabrication, equipment and processes are described and illustrated. Weld quality control procedures and structural test evaluation of panels produced on the pilot line are presented along with recommendations for the reduction of the overall cost of quality control.

Hoffman, P. R., Co., Carlisle, Pa.
TECHNICAL REPORT. Final rept. for Apr 49-Oct 51 on Contract W36-039-sc-38267. [1951] 14p.
Order from LC mi$2.40, ph$3.30 PB 145 217

Development of a quartz cutting saw to cut quartz bars or mothers into slices or wafers for the manufacture of quartz crystal blanks capable of cutting simultaneously with up to twenty (20) blades, with parallel sides on ZZ' rotation within the tolerance of plus or minus three minutes and plus or minus ten minutes on XX' rotation.

Office of Ordnance Research, Durham, N. C.
PROCEEDINGS OF THE ORDNANCE CONFERENCE [NO. 4] ON OPERATIONS RESEARCH HELD AT HEADQUARTERS, U. S. ORDNANCE MISSILE COMMAND 1-3 APRIL 1959. [1959] 175p. 29 refs. Rept. no. OORR 59-3.
Order from LC mi$8.10, ph$27.30 PB 145 381

Contents:
Some aspects of experimental design in operations research
Mathematical models and the utilization of these models
Computer played war games
Aspects of operations research in missile system testing
Discounted least squares
A practical application of the waiting line theory for the optimum allocation of machine repair operators
Linear programming applied to economic selection of materials for furnace charges
An optimal method for product development
Variations of the "Tolerance-Limit Test" problem
Analysis of demand rates
A computer simulation of small combat actions
Army logistics research
Future operations research problems in ordnance logistics
(See also PB 139 625)

Rodman Lab., Watertown Arsenal, Mass.
ECONOMIC ANALYSIS FOR TURNING WITH CERAMIC TOOLS, by Roy Mennell. Dec 59, 63p. 36 refs. Rept. no. RPL 23/11.
Order from OTS $1.75 PB 161 466

By constructing a cost model based on an empirical description of tool-life data and including the variables of machining speed, feed, machine life, type of machine, and tool material, it is possible to determine the conditions which give the least machining cost. Included in the analysis are restrictions of available lathe speed and horsepower which must be considered because present production equipment is designed for conventional carbide tools utilizing smaller speeds and less horsepower. A method of discounting all costs of a chain of equipment, similar to accepted equipment investment analysis, is described for obtaining the cost for the use of the equipment per minute of operation.

Stanford U., Calif.
A POSTSCRIPT TO "DYNAMIC PROBLEMS IN THE THEORY OF THE FIRM", by Harvey M. Wagner. Technical rept. no. 72 on Contract N6onr-251(33). 23 Mar 59, 11p. 3 refs.
Order from LC mi$2.40, ph$3.30 PB 145 389

A previous paper discussed the combined use of traditional economic constructs and dynamic programming for solutions to several inter-temporal problems in the theory of the firm (that produces a single commodity). As a specific application of these techniques, a method was presented for solving a dynamic version of the economic lot size model. The purpose of this postscript is (i) to demonstrate the algorithm suggested for the dynamic economic lot size model is also applicable to situations in which the cost curves (which may differ from period to period) have non-increasing marginal costs as a function of output, e. g., due to quantity discounts, and (ii) to describe a forward algorithm for solving optimal pricing and output problems in which the cost curves have non-decreasing marginal costs as a function of output.

MATERIALS

Army Chemical Warfare Labs., Army Chemical Center, Md.
SIXTH MATERIALS REVIEW, by Arthur Lyem. Nov 59, 93p. 255 refs. CWL Special Publication 4-11.
Order from OTS $2.25 PB 161 463

The purpose of this periodic review is to present information on important technical and scientific high lights regarding materials research here and abroad, principally in the polymer and plastics field. The information recorded herein is intended to serve as a timely and convenient reference for development personnel seeking information relative to engineering materials of actual or potential interest in creating more efficient or economical end items. Thus, technical literature surveys culminating in the "Materials Review" will promote dissemination of selected information concerning recent world-wide technological advancements which may help to guide future exploitations of synthetics and other new materials and techniques. (See also PB 161 014)

Automation Instruments, Inc., Boulder, Colo.
INVESTIGATION OF METHODS FOR DETERMINING ACTUAL FLAW SIZE IN MATERIALS BY NON-DESTRUCTIVE ULTRASONIC TECHNIQUES, by Gerald J. Posakony and Merle R. Loetz. Rept. for 15 May 58-15 May 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5714. Dec 59, 64p. WADC Technical rept. 59-302.
Order from OTS $1.75 PB 161 530

The investigation of methods to determine actual flaw size in materials by ultrasonic non-destructive techniques has led to the development of breadboard equipment capable of displaying additional flaw information. By electronic networks, the ultrasonic reflections are displayed into a three-dimensional view of the internal structure of a flat metal part. Three dimensional pictures are included to show the resultant of the single and multiple transducer techniques. Various frequencies and materials are evaluated to establish preliminary applicability of the processes. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
NOTES ON MECHANICAL TESTING TECHNIQUES AT VERY LOW TEMPERATURES, by James E. Campbell. 19 Feb 60, 8p. 14 refs. DMIC memo. 43.
Order from OTS $0.50 PB 161 193

Several techniques have been developed for evaluating the mechanical properties of materials at temperatures in the range between -423 F (-253 C) and -452 F (-269 C), the boiling points of liquid hydrogen and liquid helium. The various techniques are discussed briefly.

Illinois U., Urbana.
STUDIES OF THE STABILITY OF HIGH TEMPERATURE RESISTANT CERAMIC COATING GLASSES, by William R. Bratschun, C. N. Williams, and Dwight G. Bennett. Rept. on Contract AF 18(603)28. July 58, 39p. 8 refs. Dept. of Ceramic Engineering rept. no. 82; AFOSR-TN-58-828; AD-202 913.
Order from LC mi$3.00, ph$6.30 PB 138 167

Chemical and physical mechanisms were studied which were believed responsible for the instabilities of the glassy phase of composite glass-metal systems when subjected to elevated temperatures over prolonged periods of time. Two prominent types of glass devitrification behavior were (1) cyclic development, disappearance and reappearance of various diffraction peaks, (2) diffraction peaks which persisted throughout the heat treating period. Single oxide additions of CaO, ZnO, TiO_2, Bi_2O_3 and CoO_2 to the simple glass all delayed the initial appearance of the devitrification products.

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
JOINING OF REINFORCED PLASTICS WITH METAL FASTENERS, RESEARCH AND DEVELOPMENT REPORT, by A. Rufolo. Research and Development rept. (Final). 12 Dec 57, 39p. 14 refs. Lab. Project 4860-Q-14; AD-203 360.
Order from LC mi$3.00, ph$6.30 PB 145 356

The problem of construction by joining plastic laminates is attacked by developing a riveting technique and the collecting of design data on holding strength of screw type fasteners. The report includes a field instruction manual for driving aluminum rivets in plastics, and a design manual giving holding strength of screws in polyester glass laminates. (Author)

Office of Naval Research, Washington, D. C.
SYMPOSIUM ON MATERIALS RESEARCH IN THE NAVY, HELD IN PHILADELPHIA, PENNSYLVANIA, MARCH 17-19, 1959, [1959] 383p. 135 refs. ONR-5, Volume 2; AD-217 823.
Order from OTS $5.00 PB 161 471

Contents: Modern materials research; Dynamics of polarization reversal process in ferroelectrics; Concepts of electronic equipment and parts reliability; Structural interplay; Fracture of ultra-high-strength steel electro-plated with Cd; Fracture toughness of materials for aircraft and missiles;

Crack propagation in hydrogen embrittled steel; Minimization of adverse effects of chrome plating on fatigue life of AISI 4340 steel and correlation of fatigue and elastic limits; Materials problems in aircraft structural fatigue; Ballistic method for determining dynamic yield strength of metals; Elevated-temperature mechanical properties of an austempered low alloy steel during continuous heating; Elevated temperature effects on structural specimens; Environmental effects in high-temperature creep and fatigue; Size effect on the tensile properties of large bars of AISI4340 steel; Material problems in space technology; High-temperature strain gages for structural testing; Electron probe microanalyzer for materials research; Weldability of ultra-high-strength steels; Determination of wear behavior of plated Ti alloy; Reference radiographs for Naval aircraft casting procurement; Navy dry film development; Sliding friction and wear under high velocity and bearing pressures; Photodetector parameters; Annealing procedures and results for evaporated InSb films; Zone concept of crystal growth; Properties of garnets; Detecting intergranular corrosion susceptibility in Al alloys. (See also PB 161 470)

Office of Naval Research, Washington, D. C.
SYMPOSIUM ON MATERIALS RESEARCH IN THE NAVY, HELD IN PHILADELPHIA, PENNSYLVANIA, MARCH 17-19, 1959. [1959] 414p. 110 refs. ONR-5, Volume 1; AD-217 822.
Order from OTS $6.00 PB 161 470

Contents: Toxicology in relation to Navy material problems; Reliability as applied to materials research and selection; Development of urethane plastic foams and inorganic ceramic foams for precision radomes; Reinforced plastics for rocket motors and re-entry heat shields; Development in reinforced plastics at the Naval Ordnance Laboratory; The phosphinic nitrides - potential high-temperature polymeric dielectrics; Effects of elevated temperatures on electrical properties of thermosetting plastics; Laminated fabrics structural material of airship envelopes; Foreign woods of interest to the Navy for shipbuilding applications; Reliability of Navy aircrew safety and survival equipment mechanical systems - Material selection and manufacturing processes; Deterioration; Response of aircraft skin materials to radiation from high-temperature sources; Choice of rubbers for gaskets in nuclear radiation fields; Nuclear radiation effects in magnetic core materials and permanent magnets; Corrosion mechanisms in the reaction of steel with water and oxygenated solutions at room temperature and 316°C; Recent contributions of chemistry in the prevention and control of corrosion in the Navy; Deterioration of plasticized polymeric materials; Environmental deterioration of rigid plastics; A discussion of some of the problems of thermoelectric efficiency and coefficient of performance; Thermal properties of cadmium antimonide; Some aspects of the luminescence of glass and its applications.

Ceramics and Refractories

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
REFRACTORY MATERIALS, by R. I. Jaffee and D. J. Maykuth. 26 Feb 60, 35p. 45 refs. DMIC memo. 44.
Order from OTS $0.50 PB 161 194

Technical requirements for materials in advanced applications have become so broad that it is now essential to consider nonmetallic as well as metallic materials. The cutoff in melting point between refractory and nonrefractory materials will be selected at 1800 C. This has been done to include as refractory materials: chromium as a metal, molybdenum disilicide as an intermetallic compound, and titanium dioxide as an oxide. 122 refractory materials considered include graphite, 12 refractory metals, 18 carbides, 13 oxides, 12 nitrides, 17 silicides, 19 borides, 22 sulfides, and 8 intermetallic compounds.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
METHODS OF BLENDING AND MOLDING GLASS-FLAKE LAMINATES, by Paul H. Rothschild. Apr 59, 9p. Technical notes no. 29; AD-216 493.
Order from LC mi$1.80, ph$1.80 PB 146 158

Several experimental techniques for coating glass flakes with resin were tried. The addition of reactive diluents to reduce the viscosity of the resin proved the most satisfactory. The use of a roll mill offered most promise as a method of blending the resin and flakes, though more work is needed to develop this technique.

New York State Coll. of Ceramics, Alfred U.
METAL FIBER REINFORCED CERAMICS, by J. J. Swica, W. R. Hoskyns and others. Rept. for 1 Sep 58-31 Aug 59 on Ceramic and Cermet Materials, Contract AF 33(616)5298. Jan 60, 50p. 5 refs. WADC Technical rept. 58-452, Pt. 2.
Order from OTS $1.25 PB 161 481

The principal geometric variables involved in ceramic-refractory metal fiber composites were evaluated using thermal shock resistance as the most important criteria. Several different ceramic-metal fiber composites were investigated. Using the alumina-molybdenum and alumina-mullite-molybdenum fiber systems, the comparative properties of the two basic types of composites were demonstrated. Composites were developed which had flexural strengths exceeding 30,000 psi following four thermal shock cycles. (Author) (See also PB 151 610)

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
CALCULATION OF DETONATION PARAMETERS FOR GASEOUS MIXTURES, by Bernard T. Wolfson and Robert G. Dunn. Rept. on Research and Combustion Kinetics. May 59, 101p. 28 refs. WADC Technical note 57-309; AD-131 024.
Order from OTS $2.50 PB 161 477

A simplified and straight forward yet precise method for the calculation of all detonation parameters for gaseous mixtures is presented. The equations upon which the calculation procedure is based were derived directly from the conservation equations without approximations and involve only nondimensional quantities. The use of the method of calculation developed is illustrated by means of sample calculations. The agreement between values calculated by this method and experimental values is quite satisfactory. The calculation method developed is readily adaptable to computations by automatic computing machines as well as by manually-operated machines. (Author)

Atlantic Research Corp., Alexandria, Va.
INVESTIGATION TO DETERMINE BUILDUP OF A STATIC ELECTRIC FIELD CHARGE IN A ROLLING FLUID TRANSPORTER, by John H. Morgenthaler. Final rept., phase III, on Contract DA 44-177-TC-461. 28 Sep 59, 17p. Proj. 9-47-16-000, 104MT.
Order from LC mi$2.40, ph$3.30 PB 145 238

The purpose of the work of Phase III was to evaluate the potential hazard during filling and emptying of rolling fluid transporters with JP-4 fuel at flow rates in excess of 15 gpm. Attempts were made to detect static-electrical discharges during filling and emptying of rolling fluid transporters with 350 to 400 gallons of fuel. Flow rates ranging from 15 to 20 and from 25 to 35 gpm were used during the filling and emptying operations, respectively. Fuel temperatures were between 75 and 80°F in the runs at ambient temperature, and between 30 and 35°F in the cold runs. No evidence of any static-electrical discharges during filling or emptying of the rolling fluid transporter was obtained under the conditions of these tests which appear reasonably to simulate field operations. (Author) (See also PB 143 323)

Atlantic Research Corp., Alexandria, Va.
RESEARCH ON SOLID-PROPELLANT COMBUSTION, by Raymond Friedman, Joseph B. Levy, and Keith E. Rumbel. Final technical rept. for July 55-Oct 59 on Contract AF 18(600)1502. 30 Nov 59, 19p. 13 refs. AFOSR-TR-59-192; AD-230 724.
Order from LC mi$2.40, ph$3.30 PB 145 684

The goal of the present research program has been to gain understanding of the combustion mechanism of solid propellants containing ammonium perchlorate as oxidizer. This goal has been pursued by the study of the self-deflagration of pressed pellets of ammonium perchlorate. The results and progress of this program have been described in three technical notes.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
FIRST YEAR OF BULK PROPELLANT SURVEILLANCE UNDER MILITARY STANDARD 1231 (ORD), by Norman E. Beach. Dec 59, 32p. 7 refs. Technical memo. no. ACS-4-59; AD-230 722.
Order from LC mi$3.00, ph$6.30 PB 145 709

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELASTOMERIC-BINDER AND MECHANICAL-PROPERTY REQUIREMENTS FOR SOLID PROPELLANTS, by Thor L. Smith. Rept. on Contract DA 04-495-ORD-18. 7 Jan 59, 18p. 12 refs. Memo. no. 20-178; AD-211 650.
Order from LC mi$2.40, ph$3.30 PB 145 078

A summary is presented of the many factors that must be considered in selecting new elastomeric binders for castable composite propellants and in improving the properties of propellants under development. A brief description is given concerning methods of preparing and using composite propellants, and the mechanical properties required of cast-in-place case-bonded grains are discussed qualitatively. Methods of evaluating some time-dependent tensile properties are described, and some illustrative data are given. Finally, the properties desired of an ideal elastomeric binder are presented together with some relations between the mechanical properties of unfilled binders and propellants. The influence of ballistic-property requirements on the choice of binders and on propellant mechanical properties is also considered. (Author)

Little, Arthur D., Inc. [Cambridge, Mass.]
A TEMPERATURE REGULATED IGNITION SOURCE, by John Preston and Leland E. Ashman. Rept. on Contract AF 18(603)109. 1 Jan 59, 24p. 4 refs. [AFOSR]-TN-59-30; AD-209 202.
Order from LC mi$2.70, ph$4.80 PB 145 622

Since the current to maintain a wire at a constant temperature depends largely upon the environment of the wire, the current and the temperature are a means of measuring the properties of that environment. The temperature controller described here is capable of heating a fine wire--of the order of a few mils in diameter--to some temperature between 700°C and the melting temperature, and holding the temperature constant to within a few degrees. The detector is a photomultiplier that monitors radiation from the center of the wire; changes in radiation result in compensating changes in the current. The controller responds within a millisecond to sudden changes in the environment of the wire. This rapid response is useful for detecting the onset of ignition in reactive gases and perhaps for measuring the thermal properties of nonreactive gases. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
ON THE ASSUMPTIONS UNDERLYING DROPLET VAPORIZATION AND COMBUSTION THEORIES, by F. A. Williams. Technical note on Contract AF 49(638)412. Nov 59, 49p. 11 refs. LMSD-288098; AFOSR-TN-59-1148.
Order from LC mi$3.30, ph$7.80 PB 145 845

A study is undertaken to determine the range of validity of the assumptions that (a) the liquid temperature is constant and equal to the boiling temperature for a burning droplet, (b) the instantaneous vaporization rate of a droplet at a given size is the same as that of a constant-diameter sphere of the same size, and (c) the duration of the initial unsteady period is much less than the total vaporization time of a droplet.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
HIGH TEMPERATURE EVALUATION PROCEDURES FOR LUBRICANTS. PART I. DESIGN DEVELOPMENT AND INSTRUMENTATION OF A 1000°F OXIDATION CORROSION BATH AND 400°F VISCOSITY BATHS, by Vernon A. Lauer and Donald C. Trop. Rept. for Feb 58-Apr 59 on Avaition Lubricants. Aug 59, 23p. 3 refs. WADC Technical note 59-160, Pt. 1.
Order from OTS $0.75 PB 161 506

The design, development and instrumentation is described of a high temperature aluminum block bath capable of attaining and controlling temperatures up to 1000°F ±5°F. Two high temperature viscosity baths capable of attaining and maintaining 400°F and 700°F respectively are also described. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE QUANTITATIVE ANALYSIS OF N-PHENYL-ALPHA-NAPHTHYLAMINE AND 5-ETHYL-10, 10-DIPHENYLPHENAZASILINE IN ALIPHATIC TRIESTER BASE STOCK FLUID, by Lee D. Smithson and James T. Thompson. Rept. for July-Sep 59 on Materials Analysis and Evaluation Techniques. Jan 60, 20p. 2 refs. WADC Technical rept. 59-666.
Order from OTS $0.50 PB 161 502

A quantitative ultra-violet method has been developed for determining the quantity of two antioxidant additives (n-phenyl-alpha-naphthylamine and 5-ethyl-10, 10-diphenylphenazasiline) when blended with an aliphatic triester base stock fluid. The method has been applied to engine tested samples. (Author)

Leather and Textiles

Navy Electronics Lab., San Diego, Calif.
VISIBILITY OF SIGNAL FLAGS, by A. Morris and J. M. Hood, Jr. Research and Development rept. for May 56-Dec 57. 17 Oct 58, 11p. 1 ref. NEL/Report 864; AD-213 904.
Order from LC mi$2.40, ph$3.30 PB 145 627

A study was made to determine the factors contributing to the visibility of standard signal flags as seen through standard optical devices under various atmospheric conditions. The prevailing condition of illumination was found to be the major contributing factor to such visibility. The use of optical aids is limited by ship size, since the effectiveness of high magnification is hindered by unsteadiness of small ships. A pilot study employing 7X50 binoculars with miniature signal flags gave recognition ranges in agreement with previously reported ranges for full-scale flags. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
AN EVALUATION OF NEW FIBER BLENDS IN ARMY SUMMER UNIFORM FABRICS, by C. J. Monego and S. J. Kennedy. May 59, 73p. 16 refs. Textile Series rept. no. 108.
Order from OTS $2.00 PB 161 331

This report presents the results of a detailed laboratory and field study on nine tropical-type blended fabrics which were developed for this test through close cooperation between fiber producers and fabric manufacturers. The development of each fabric was based on the fabric manufacturer's previous experience with that particular blend on the civilian market, and only those blends which had achieved a marked consumer preference were considered. The results of this study show that the 60/40 polyester/wool blend performed well in laboratory tests and ranked higher than the other fabrics in field tests.

MATHEMATICS

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE PROBABILITY INTEGRALS OF THE RANGE AND OF THE STUDENTIZED RANGE. PROBABILITY INTEGRAL AND PERCENTAGE POINTS OF THE STUDENTIZED RANGE; CRITICAL VALUES FOR DUNCAN'S NEW MULTIPLE RANGE TEST, by H. Leon Harter, Donald S. Clemm and Eugene H. Guthrie. Rept. on Transformations in the Analysis of Variance. Oct 59, 314p. 15 refs. WADC Technical rept. 58-484, Volume II.
Order from OTS $5.00 PB 161 517

A description is given of the computation and use of tables of the probability integral of the studentized range, percentage points of the studentized range, and critical values for Duncan's new multiple range test, all based upon samples from a normal distribution. The following tables are included: (1) a table (to six decimal places or six significant figures, whichever is less accurate) of the probability integral of the studentized range, $Q=w/s$, with varying intervals (small enough to make the table interpolable) for samples of size $n=2(1)20(2)40(10)100$, with degrees of freedom $\nu=1(1)20$, 24, 30, 40, 60, and 120 for the independent estimate s of the population standard

deviation; (2) a table (to four decimal places or four significant figures, whichever is less accurate) of the percentage points of the studentized range corresponding to cumulative probabilities P=0.001, 0.005, 0.01, 0.025, 0.05, 0.1 (0.1) 0.9, 0.95, 0.975, 0.99, 0.995, and 0.999 for the same values of n and ν, also for $\nu = \infty$; and (3) a table (to four decimal places or four significant figures, whichever is less accurate) of the critical values for Duncan's new multiple range test at significance levels α=0.1, 0.05, 0.01, 0.005, and 0.001, corresponding respectively to protection levels P=$(0.9)^{n-1}$, $(0.95)^{n-1}$, $(0.99)^{n-1}$, $(0.995)^{n-1}$, and $(0.999)^{n-1}$, for the same values of n and ν (including $\nu = \infty$). (Author) (See also PB 161 037)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE ADMISSIBILITY OF PITMAN'S ESTIMATOR FOR TWO LOCATION PARAMETERS, by Charles Stein. Technical rept. no. 25 on Contract Nonr-225(21). 6 Feb 59, 26p. 4 refs; AD-211 079.
Order from LC mi$2.70, ph$4.80 PB 145 597

Applied Mathematics and Statistics Lab., Stanford U., Calif.
APPLICATIONS OF ALMOST PERIODIC COMPACTIFICATIONS, by K. Deleeuw and I. Glicksberg. Technical note no. 9 on Contract AF 49(638)294. 28 Dec 59, 63p. 20 refs. AFOSR-TN-59-1174.
Order from LC mi$4.50, ph$12.30 PB 145 552

Almost periodic compactifications of operator semigroups are constructed and applications to the theory of weakly almost periodic functions and to ergodic theory are given. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A BIVARIATE TCHEBYCHEFF INEQUALITY FOR CERTAIN CONVEX SETS, by Albert W. Marshall and Ingram Olkin. Technical rept. no. 26 on Contract Nonr-225(21). 20 Mar 59, 30p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 145 598

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE ISOMETRIES OF H_1, by Karel Deleeuw. Technical note no. 8 on Contract AF 49(638)294. 30 Nov 59, 28p. 9 refs. AFOSR-TN-59-1111.
Order from LC mi$2.70, ph$4.80 PB 145 516

All of the linear isometries of H_1 onto itself are shown to be induced by conformal maps of the unit disk. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
MULTIPLIERS OF COMMUTATIVE BANACH ALGEBRAS, by Ju-Kwei Wang. Technical note no. 10 on Contract AF 49(638)294. 29 Dec 59, 39p. 9 refs. AFOSR-TN-59-1288.
Order from LC mi$3.00, ph$6.30 PB 145 507

Applied Mathematics and Statistics Lab., Stanford U., Calif.
PARTIAL DIFFERENTIAL EQUATIONS WITH MORE THAN TWO INDEPENDENT VARIABLES IN THE COMPLEX DOMAIN, by P. R. Garabedian. Technical rept. no. 82 on Contract Nonr-225(11). 19 Mar 59, 69p. 12 refs.
Order from LC mi$3.90, ph$10.80 PB 145 596

In this paper we shall be primarily concerned with linear partial differential equations of the second order whose coefficients are analytic. We shall be interested in properties of the solutions of such equations which can be studied by means of an analytic continuation into the domain of complex values of the independent variables. The case of two independent variables has been thoroughly investigated from this point of view, and our contribution here will therefore be to problems involving three or more variables. The significance of such a study lies in the hope it offers of extending to several variables some of the theories for partial differential equations in two variables which depend on conformal mapping or on the introduction of characteristic coordinates,

Applied Mathematics and Statistics Lab., Stanford U., Calif.
UNIFORM BOUNDEDNESS FOR GROUPS, by Irving Glicksberg. Technical note no. 11 on Contract AF 49(638)294. 30 Dec 59, 19p. 5 refs. AFOSR-TN-60-33.
Order from LC mi$2.40, ph$3.30 PB 145 790

Certain analogues of the uniform boundedness results for Banach spaces are established for locally compact abelian groups. (Author)

California U., Berkeley.
A COMPARISON THEOREM FOR ELLIPTIC EQUATIONS, by M. H. Protter. Technical rept. no. 1 on Contract AF 49(638)398. Sep 58, 7p. 3 refs. AFOSR-TN-58-842; AD-203 332.
Order from LC mi$1.80, ph$1.80 PB 138 166

Hartman and Wintner (Proc. Amer. Math. Soc. vol. 6 (1955) p. 862ff.) obtained a Sturmian comparison theorem for self-adjoint second order linear elliptic equations of the form

$$\sum_{i,j=1}^{n} \frac{\partial}{\partial x_i}\left(a_{ij}\frac{\partial u}{\partial x_j}\right) + fu = 0 \qquad a_{ij} = a_{ji}$$

in a bounded domain D with boundary Γ. It is the purpose of this note to extend their result to general second order linear elliptic equations.

California U., Berkeley.
A NOTE ON CERTAIN POLYNOMIAL ALGEBRAS, by Emery Thomas. Technical rept. no. 12 on Contract AF 49(638)79. Jan 60, 11p. 4 refs. AFOSR-TN-59-937.
Order from LC mi$2.40, ph$3.30 PB 145 556

This note considers polynomial algebras defined over integral domains of characteristic 2. For each algebra a derivation β is defined and the main theorem gives a splitting of the algebra relative to β. The theorem is then applied to several examples from Algebraic Topology: namely, to the mod. 2 cohomology algebras of the Grassmann complexes, and to a subalgebra W of the Thom algebra N of non-oriented differentiable manifolds. (Author)

California U., Berkeley.
SECOND ORDER ELLIPTIC EQUATIONS IN SEVERAL VARIABLES AND HOLDER CONTINUITY, by Charles B. Morrey, Jr. Technical rept. no. 5 on Contract Nonr-222(62). Mar 59, 37p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 254

In this paper are discussed the Hölder continuity of the solutions of equations of the form $\int_G [v_{,\alpha}(a^{\alpha\beta}u_{,\beta}+b^{\alpha}u+e^{\alpha})+v(c^{\alpha}u_{,\alpha}+du+f)]dx = 0$ for all $v \in H^1_{2,0}$ on G where it is assumed that the $a^{\alpha\beta}$ are bounded and measurable and satisfy the uniform ellipticity condition, the coefficients b^{α} and $c^{\alpha} \in L_{2p}$ and $d \in L_p$ for some $p > \nu/2$ (ν being the number of x variables), the $e^{\alpha} \in L_2$ and $f \in L_1$, and e and f satisfy certain integral growth conditions.

California U., Los Angeles.
COMPUTER EVALUATED TABLES FOR THE SIMPLIFICATION OF BOOLEAN FORMULAS, by Aviezri Fraenkel (Weizmann Inst. of Science). Rept. on Contract Nonr-233(52). Mar 59, 23p. 5 refs. Dept. of Engineering rept. no. 59-16.
Order from LC mi$2.70, ph$4.80 PB 145 118

There exist 2^{2^n} n-variable Boolean functions. The two tables presented herein, involve the cases n = 3 and n = 4 respectively. Each table gives $N_1 = N_1$ (n, k, e, t) and $N_2 = \sum_t N_1$, where k is the number of units in the truth table representation of functions, e is a generally triple-number quantity, expressing the number of elements in the set of prime implicants; the number of elements in an equivalent simplest disjunctive normal formula; and the number of equivalent distinct simplest disjunctive normal formulas. (The number of elements of a formula is defined to be the total number of occurrences of variables or their negations in the formula.) t is a parameter which states presence or absence of units at some fixed places of truth tables. The two tables were computed by means of a simplification method described elsewhere, which was programmed on a digital computer. The complete tables were printed out directly from the output equipment of the computer.

Carnegie Inst. of Tech., Pittsburgh, Pa.
CHARACTERISTIC VALUES ASSOCIATED WITH A CLASS OF NONLINEAR SECOND-ORDER DIFFERENTIAL EQUATIONS, by Zeev Nehari. Technical rept no. 31 on Contract AF 49(638)227. Dec 59, 46p. 7 refs. AFOSR-TN-59-1262.
Order from LC mi$3.30, ph$7.80 PB 145 492

Chicago U., Ill.
INVESTIGATIONS IN THE THEORY OF PARTIAL DIFFERENTIAL EQUATIONS, by Lawrence M. Graves. Final rept. for 1 July 55-31 Dec 59 on Contract DA 11-022-ORD-1833. Dec 59, 6p.
Order from LC mi$1.80, ph$1.80 PB 145 713

Chicago U., Ill.
REVIEW OF SOME RESULTS IN COLLINEATION GROUPS, by D. R. Hughes. Rept. on Contract AF 18(600)1383. Oct 59, 18p. 28 refs. AFOSR-TN-59-1124.
Order from LC mi$2.40, ph$3.30 PB 145 486

In this paper an attempt is made to review a part of the subject of collineation groups of finite projective planes. The more or less classical aspects of Desarguesian geometry are largely disregarded and the infinite planes are skipped. An example due to Marshall Hall shows that there are infinite projective planes with trivial collineation groups (and it is also probably possible to construct an infinite plane with any prescribed countably infinite group as exactly its full collineation group). But in the finite case, every known plane has a rather "large" collineation group. Whether this is an accident of our limited knowledge, or a theorem yet to be proved, is one of the most important problems in the study of finite planes.

Chicago U., Ill.
SUBJECTIVE PROBABILITY AND STATISTICAL PRACTICE, by Leonard J. Savage. Rept. on Contracts AF 49(638)391 and Nonr-2121(09). 28 Oct 59, 46p. 116 refs. AFOSR-TN-59-1161.
Order from LC mi$3.30, ph$7.80 PB 145 491

The concept of subjective, or personal, probability has much to contribute to statistical practice. It leads to criticism and amplification of conventional methods and the development of new ones. This is especially well illustrated in problems of estimation, where precise measurement can be shown to justify sharp and rather well-defined final probability distributions of parameters. (Author)

Chicago U., Ill.
TRIPLE TORSION PRODUCTS AND MULTIPLE KUNNETH FORMULAS, by Saunders Mac Lane. Rept. on Contract AF 18(600)1383. Nov 59, 25p. 3 refs. AFOSR-TN-60-45.
Order from LC mi$2.70, ph$4.80 PB 145 512

Chicago U., Ill.
THE WEIERSTRASS CONDITION FOR MULTIPLE INTEGRAL VARIATIONAL PROBLEMS INVOLVING HIGHER DERIVATIVES, by Lawrence M. Graves. Technical rept. no. 9 on Investigations in the Theory of Partial Differential Equations, Contract DA 11-022-ORD-1833. Nov 59, 11p. OOR rept. 1444. 12-M.
Order from LC mi$2.40, ph$3.30 PB 145 179

It is well known that the necessary condition of Weierstrass for multiple integrals involving several dependent variables z_k and only their first partial derivatives involves variations of the derivatives of the form $D_{x_j}\zeta_k = C_k\alpha_j$, that is, the matrix of these derivatives has rank one at most. This report treats the case when derivatives of higher order appear.

Harvard U., Cambridge, Mass.
COMPLETE IDEALS IN REGULAR LOCAL RINGS OF DIMENSION 2, by Oscar Zariski. Rept. on Contract AF 49(638)494. Dec 59, 61p. 1 ref. AFOSR-TN-59-1114.
Order from LC mi$3.90, ph$10.80 PB 145 484

The theory of complete ideals in polynomial rings k[x, y] of two variables presents some particularly striking features. This theory, developed by the author in 1938, will be presented in the appendix in a much simpler form and in greater generality. The generalization consists in dealing with arbitrary regular local rings of dimension 2, rather than with that special class of such rings which come from quotient rings of k[x, y] with respect to maximal ideals in k[x, y]. Very little is known about complete ideals in regular local rings of dimension greater than 2. It is almost certain that the theory developed here cannot be generalized to higher dimension without substantial modifications of both statements and proofs. (Author)

Hebrew U. (Israel).
THE L_p APPROACH TO THE DIRICHLET PROBLEM, PART I, by Shmuel Agmon. Technical note no. 7 on Contract AF 61(052)187. Aug 59, 100p. 32 refs. AFOSR-TN-59-815.
Order from LC mi$5.40, ph$15.30 PB 145 312

In this paper a L_p approach is presented to the Dirichlet problem and to related regularity problems for higher order elliptic equations.

Hebrew U. (Israel).
ON THE CONCEPT OF A DIFFERENTIALLY CLOSED FIELD, by Abraham Robinson. Technical note no. 6 on Contract AF 61(052)187. July 59, 38p. 14 refs. AFOSR-TN-59-814.
Order from LC mi$3.00, ph$6.30 PB 145 483

A concept of differentially closed field is formulated containing Kolchin's universal extension as a special case. Applications include a theorem on the specialisation of parameters and a constructive version of Ritt's Nullstellensatz. (Author)

Hebrew U. (Israel).
ON SOME COMPOSITIONS OF HADAMARD TYPE IN CLASSES OF ANALYTIC FUNCTIONS, by C. Loewner and E. Netanyahu. Technical note no. 5 on Contract AF 61(052)187. June 59, 7p. 1 ref. AFOSR-TN-59-843; AD-220 708.
Order from LC mi$1.80, ph$1.80 PB 145 310

Let S be the class of regular, and Schlicht functions in the unit circle. Let $f(z)=\sum_{n=1}^{\infty} a_n z^n$, $a_1=1$ and $g(z)=\sum_{n=1}^{\infty} b_n z^n$, $b_1=1$, be the representing power series of 2 elements of S. Then the composition $h(z)=\sum_{n=1}^{\infty} a_n b_n z_n$ leads to an element of the same class. The weak conjecture that h(z) has a non-vanishing derivative in $|z|<1$ is proved to be false.

Institute for Advanced Study, Princeton, N. J.
ANOTHER CUTPOINT THEOREM FOR PLANE CONTINUA, by F. Burton Jones. Rept. on Contract AF 18(600)1109. Oct 59, 5p. 2 refs. AFOSR-TN-59-1123.
Order from LC mi$1.80, ph$1.80 PB 145 485

If p and q are points of different components of the interior M then the author has previously shown that some point x of M cuts p from q in M. In other words, in the given situation there is a point x of M which belongs to every subcontinuum of M which contains both p and q. However, it is not necessary that p and q belong to the same interior component if no point of M cuts between them. But it is necessary that both p and q belong to the closure of some interior component. In other words, if the closure of no interior component of M contains both p and q, then some point x of M cuts p from q in M. (Author)

Institute for Advanced Study, Princeton, N. J.
COMMON TRANSVERSALS FOR FAMILIES OF SETS, by Branko Grünbaum. Rept. on Contract AF 49(638)253. Oct 59, 13p. 29 refs. AFOSR-TN-59-1036; AD-228 281.
Order from LC mi$2.40, ph$3.30 PB 145 069

Let a family K of compact, convex sets be given. Conditions on K are investigated for which the existence of a straight line intersecting all the members of K results from the assumption that for every k-membered sub-family of K, where k is a suitable fixed integer, there exists a straight line intersecting all the members of the subfamily. (Author)

Institute for Advanced Study, Princeton, N. J.
ON POLYHEDRA IN E^3 HAVING ALL FACES CONGRUENT, by B. Grünbaum. Rept. on Contract AF 49(638)253. Oct 59, 6p. 2 refs. AFOSR-TN-59-1129.
Order from LC mi$1.80, ph$1.80 PB 145 487

A problem of H. Steinhaus, proposed in the "New Scottish Book", is solved by the following Theorem: If all the faces of a convex polyhedron in Euclidean 3-space are congruent, then the polyhedron has an even number of faces. (Author)

Institute for Advanced Study, Princeton, N. J.
ON SOME PROPERTIES OF CONVEX SETS, by Branko Grunbaum. Rept. on Contract AF 49(638)253. Nov 59, 5p. 6 refs. AFOSR-TN-59-1157; AD-229 959.
Order from LC mi$1.80, ph$1.80 PB 145 490

A conjecture of H. Steinhaus (Fundamenta Math. 41: 284-290, 1955) on the diameters of plane sections of convex bodies in E^3 is disproved, and a positive result of a related nature is established.

Institute for Advanced Study, Princeton, N. J.
ON $u''+(1+\lambda g(x))u=0$ FOR $\int_0^\infty |g(x)|\,dx<\infty$, by R. R. D. Kemp and Norman Levinson. Rept. on Contract AF 18(600)1109. June 59, 7p. 1 ref. AFOSR-TN-59-643; AD-220 344.
Order from LC mi$1.80, ph$1.80 PB 145 297

If $g(x)\in L^1(0,\infty)$ and $u(x,\lambda)$ is the solution of $u''+(1+\lambda g(x))u=0$ which satisfies the initial conditions $u(0)=0$, $u'(0)=1$, then there are functions $r(\lambda)$ and $\Theta(\lambda)$ such that $\lim_x \{u(x,\lambda) - r(\lambda)s \text{ in } [x+\Theta(\lambda)]\}$ for real λ. It is shown that $r(\lambda)$ and $\Theta(\lambda)$ are real analytic on the real axis if $g(x)$ is real, and that $r(\lambda)>0$. The nearest singularity of r and Θ to the origin is at least a distance $\log 2[\int_0^\infty g(x)\,dx^{-1}]$ from $\lambda=0$, and the singularities are determined by the zeros of two entire functions. (Author)

Israel Inst. of Tech., Haifa.
BOUNDS FOR SUMS OF RECIPROCALS OF EIGENVALUES, by Binyamin Schwarz. Technical note no. 1 on Contract AF 61(052)194. July 59, 19p. 11 refs. AFOSR-TN-59-620; AD-217 684.
Order from LC mi$2.40, ph$3.30 PB 145 298

The differential system is considered of the form $y''(x)+\lambda p(x)y(x)=0$, where $y(\pm a)=0$, $0<a<\infty$, $p(x)>0$, and $p(x)\in C$.

Johns Hopkins U., Baltimore, Md.
A LEMMA IN THEORY OF STRUCTURAL STABILITY OF DIFFERENTIAL EQUATIONS, by Philip Hartman. Technical note no. 12 on Contract AF 18(603)41. Oct 59, 15p. 3 refs. AFOSR-TN-59-1106.
Order from LC mi$2.40, ph$3.30 PB 145 513

John Hopkins U., Baltimore, Md.
ON LOCAL HOMEOMORPHISMS OF EUCLIDEAN SPACES, by Philip Hartman. Technical note no. 13 on Contract AF 18(603)41. Oct 59, 30p. 10 refs. AFOSR-TN-59-1107.
Order from LC mi$2.70, ph$4.80 PB 145 514

Johns Hopkins U., Baltimore, Md.
ON UNIQUENESS QUESTIONS FOR HYPERBOLIC DIFFERENTIAL EQUATIONS, by John P. Shanahan. Technical note no. 11 on Contract AF 18(603)41. May 59, 18p. 8 refs. AFOSR-TN-59-650.
Order from LC mi$2.40, ph$3.30 PB 145 568

This note is concerned with questions of uniqueness, existence and convergence of successive approximations for a solution of an initial value problem, where $z_{xy}=f(x, y, z, z_x, z_y)$ and $z(x, 0)$, $z(0, y)$ are assigned. There are obtained analogues of the Nagumo and Kamke criteria in the theory of ordinary differential equations. The method employed is related to the arguments used by Viswanatham to prove the convergence of successive approximations for ordinary differential equations under conditions similar to those in Kamke's general uniqueness theorem. (Author)

Maryland U., College Park.
ALMOST UNIFORM CONVERGENCE VERSUS POINTWISE CONVERGENCE, by John W. Brace. Rept. on Contract AF 18(603)78. Aug 58, 7p. 3 refs. AFOSR-TN-58-799; AD-202 232.
Order from LC mi$1.80, ph$1.80 PB 138 063

It has been established that the topology of almost uniform convergence on the collection of all bounded continuous real valued functions over a completely regular Hausdorff space is equivalent to the topology of pointwise convergence of the extended functions over the Stone Čech compactification (PB 126 435). This raises the question as to when almost uniform convergence of a net of functions is equivalent to pointwise convergence of a net of extended functions over an enlargement of the original domain. This paper answers the question within certain restrictions.

Miami U., Coral Gables, Fla.
THE ROLE OF THE STRONG MARKOV PROPERTY IN PROBABILITY THEORY, by D. G. Austin. Research rept. no. 11 (Rept. no. 19) on Contract AF 49(638)184. Sep 59, 13p. 13 refs. AFOSR-TN-59-1035.
Order from LC mi$2.40, ph$3.30 PB 145 557

This report contains an announcement of analytic and probabilistic results on Markov processes with the emphasis on Markov chains. (Author)

Michigan State U. [East Lansing].
MULTIVARIATE BETA DISTRIBUTIONS, by Ingram Olkin. Interim technical rept. no. 15 on Contract DA 20-018-ORD-14735. 18 Dec 59, 10p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 145 710

If X and Y are independent random variables having a chi-square distribution with n and m degrees of freedom, respectively, then $(m/n)(X/Y)$ is distributed as an F-distribution with n, m d.f. In the multivariate case, the Wishart distribution plays the role of the chi-square distribution. However, there is no single natural generalization of a ratio when the elements are matrices. In this paper several generalizations which lead to multivariate analogs of the Beta or F-distribution are given.

Michigan U., Ann Arbor.
ON IMMERSION OF MANIFOLDS, by Hans Samelson. Rept. on Contract AF 49(638)104. Oct 59, 12p. 4 refs. AFOSR-TN-59-853.
Order from LC mi$2.40, ph$3.30 PB 145 309

A simple geometrical proof, using vector fields, is given for the theorem of R. Lashof and S. Smale (Ann. of Math., 68, 562-583 (1958)) to the effect that for an imbedding of a compact manifold M into a manifold M' the normal degree equals the characteristic of M modulo that of M' (or zero if M' not compact); the relevant homology class is identified. A second proof using the theory of Morse is given for the special case where M' is Euclidean space. (Author)

Michigan U. Coll. of Literature, Science, and the Arts, Ann Arbor.
RESTRICTED CLUSTER SETS, by Paul Erdos and George Piranian. Technical note on Contract AF 49(638)633. Jan 60, 8p. 3 refs. 2913-1-T; AFOSR-TN-59-1122; AD 231 397.
Order from LC mi$1.80, ph$1.80 PB 145 543

Collingwood has shown that if a function f is continuous in the upper half-plane, then the real axis contains a residual set at each of whose points each Stolz cluster set of f coincides with the complete cluster set of f. The present paper shows that the hypothesis of continuity can be dropped from Collingwood's theorem. The paper also describes a function whose segmental cluster sets exhibits a large measure of independence. (Author)

Missouri U., Columbia.
BEST FIT TO A RANDOM VARIABLE BY A RANDOM VARIABLE MEASURABLE WITH RESPECT TO A σ-LATTICE, by H. D. Brunk. Technical rept. no. 14 on Contract AF 18(600)1108. Oct 59, 34p. 12 refs. AFOSR-TN-59-1134; AD-230 193.
Order from LC mi$3.00, ph$6.30 PB 145 489

Oregon State Coll., Corvallis.
MATHEMATICS FOR DIGITAL COMPUTERS. VOLUME II. LINEAR INTEGRAL EQUATIONS, by E. G. Kimme, A. T. Lonseth and others. Rept. on Contract AF 33(616)3216. Sep 59, 132p. 63 refs. WADC Technical rept. 57-556, Volume II.
Order from OTS $2.75 PB 161 525.

Methods for the numerical solution of linear integral equations of the Fredholm type, with recommendations as to their probable usefulness on high-speed digital computers, is presented in this report. Particular emphasis is on non-homogeneous Fredholm equations of the second kind. A selected bibliography with reviews and a general bibliography appear at the end of the report. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
PLASTIC LIMIT ANALYSIS AND INTEGRAL LINEAR PROGRAMS, by C. E. Lemke, A. Charnes, and O. C. Zienkiewicz (Northwestern U.). Rept. on Contracts Nonr-591(13) and Nonr-1228(10). 17 Feb 59, 11p. 7 refs. RPI MathRep no. 12.
Order from LC mi$2.40, ph$3.30 PB 145 595

The purpose of this paper is to apply some newly-developed techniques for solving integral-solution linear programs to a problem which arises in the Theory of Plastic Collapse of Structures.

Stanford U., Calif.
THE CAPACITY METHOD OF QUADRATIC PROGRAMMING, by H. S. Houthakker. Technical rept. no. 71 on Contract N6onr-25133. 23 Mar 59, 43p. 6 refs. AD-213 000.
Order from LC mi$3.30, ph$7.80 PB 145 250

Quadratic programming is the art of finding nonnegative values of several variables $x_1, \ldots, x_n$ which maximize a polynomial of the second degree $(x_1, \ldots, x_n)$ while satisfying given constraints, which are assumed to be linear. In economics, quadratic programming is of interest because of the increase in flexibility and realism which it provides over linear programming. By postulating appropriate linear dependencies, for instance between demand and price, it is possible to expand linear programming into quadratic programming. An example of the monopoly problem is worked out. Another interpretation for which the capacity method was first developed, is the choice of commodities bought by a consumer whose utility function can be written as a quadratic expression, and who is unable to buy negative quantities. This case is used to illustrate the capacity method. (Author)

Syracuse U., N. Y.
ON UNIFORM APPROXIMATION BY POSITIVE LINEAR COMBINATIONS OF POLYNOMIALS OF A GIVEN SYSTEM OF FUNCTIONS, by W. B. Jurkat and G. G. Lorentz. Rept. on Contract AF 49(638)619. 17 Dec 59, 13p. 2 refs. AFOSR-TN-59-1287.
Order from LC mi$2.40, ph$3.30 PB 145 506

The main theorem gives necessary and sufficient conditions in order that each positive continuous function on [0, 1] be approximable by polynomials with positive coefficients in two given functions. Fairly general necessary conditions are found for such approximation by positive linear combinations of given functions or by powers of given functions. (Author)

Syracuse U., N. Y.
POLYNOMIAL APPROXIMATION OF CONTINUOUS FUNCTIONS ON LINEAR SPACES, by W. B. Jurkat. Technical note on Contract AF 49(638)619. 17 Dec 59, 11p. 5 refs. AFOSR-TN-59-1235.
Order from LC mi$2.40, ph$3.30 PB 145 554

Approximation of continuous functions on separable closed subsets of a Frechet space X by polynomials with coefficients in X. (Author)

Syracuse U., N. Y.
RELATIONS BETWEEN FUNCTION SPACES, by G. G. Lorentz. Rept. on Contract AF 49(638)619. 17 Dec 59, 8p. 4 refs. AFOSR Technical note 59-1286; AD 231 609.
Order from LC mi$1.80, ph$1.80 PB 145 505

Necessary and sufficient conditions are given, in terms of the functions ϕ and W, in order that an Orlicz space L_ϕ be isomorphic to a space $\Lambda(W)$. (Author)

Texas A. & M. Research Foundation, College Station.
A METHOD FOR SOLVING THE MODIFIED PRIMITIVE EQUATIONS, by Yoshikazu Sasaki. Scientific rept. no. 4 on Contract AF 19(604)2222 and Scientific rept. no. 2 on Contract AF 19(604)1565. Oct 58, 13p. 1 ref. Ref. 58-20T; AFCRC TN-58-649.
Order from LC mi$2.40, ph$3.30 PB 139 305

A method is proposed for solving the modified primitive equations of motion, continuity, and thermodynamics. New potentials are defined in order to simplify the introduction of boundary conditions. The second order derivatives of these potentials are the components of velocity. A convenient technique for obtaining the solutions is used in order to minimize errors, and to avoid certain computational instability. The latter arises from the advection terms, and when the oscillation is faster than the internal gravity wave.

Wayne State U., Detroit, Mich.
HOMOTOPY AND ISOTOPY PROPERTIES OF TOPOLOGICAL SPACES, by Sze-Tsen Hu. Technical note no. 6 on Contract AF 49(638)179. Nov 59, 24p. 6 refs. AFOSR-TN-59-1108.
Order from LC mi$2.70, ph$4.80 PB 145 515

The objective of the present note is twofold. First, the general tests for homotopy and isotopy properties of topological spaces are established in the first three sections in terms of hereditary and weakly hereditary properties. Second, a general method of constructing new homotopy and isotopy invariants of topological spaces are described in the last section. (Author)

Wayne State U., Detroit, Mich.
TOLERANCE LIMITS BASED ON LIFE TEST DATA TAKEN FROM AN EXPONENTIAL DISTRIBUTION, by Benjamin Epstein. Technical rept. no. 1 on Contract Nonr-2575(00). 1 Feb 59, 11p.
Order from LC mi$2.40, ph$3.30 PB 145 581

(See also PB 140 703)

Air Force Cambridge Research Center, Bedford, Mass.
THE USE OF DIGITAL COMPUTERS IN SPEECH ANALYSIS AND SYNTHESIS, by C. P. Smith. Nov 59, 13p. AFCRC-TN-59-958.
Order from LC mi$2.40, ph$3.30 PB 145 246

A new approach toward the goal of compressed digital speech communication is based on speech data reduction in successive stages. First, the voice signal is measured in a Vocoder type of analyzer and the output information digitized. The spectrum pattern data is then reduced by selecting the "best approximations" from a stored set of spectrum patterns, and reading out the pattern "serial numbers." This data is further reduced by selection of the "best approximations" from a stored set of pattern sequences and pitch sequences. The serial numbers of the sequences are transmitted. At the receiver, an inverse process expands the information to a voice output. (Author)

Columbia U. School of Engineering, New York.
SAMPLED DATA CONTROL SYSTEMS CONTAINING PERIODICALLY VARYING MEMBERS, by Bernard Friedland. Technical rept. T-39/B on Contract AF 18(600)677. 12 Nov 59, 33p. 5 refs. CU-60-59-AF-677-EE; AFOSR-TN-59-1215; AD-230 744.
Order from LC mi$3.00, ph$6.30 PB 145 553

The Z-transform method is extended to sampled-data systems containing periodically varying members. Every member of such a system may be characterized by an N x N "transfer matrix" H(z) whose elements are pulse transfer functions. The input-output relation for every member is given by $\underline{Y}(z) = \underline{H}(z)\,\underline{X}(z)$ where $\underline{X}(z)$ and $\underline{Y}(z)$ are 1 x N matrices (vectors) whose elements are the "skip-sampled Z-transforms" of the input and output, respectively. By the use of matrix algebra the transfer matrices of the members are combined to obtain the overall transfer matrix of the system, from which the response of the system may be determined. The method is illustrated by application to the following problems: (1) Multirate sampled systems (2) Systems in which samples are periodically omitted and holding circuit with periodically varying hold time is employed (3) Use of a periodically varying amplifier to achieve deadbeat performance.

Electronics Research Lab., U. of California Berkeley.
THEORETICAL ASPECTS OF MINIMAL-SCAN PATTERN-RECOGNITION, by Arthur Gill. Rept. on Contract Nonr-222(53). 23 Mar 59, 81p. 23 refs. IER Series no. 60; Issue no. 233; AD-216 594.
Order from LC mi$4.80, ph$13.80 PB 145 500

Recognition of finite sets of visual patterns can be effected by scanning the individual "cells" of each pattern, and comparing the resulting sequence of signals with a preconstructed table of such sequences.

The dissertation presents readily programmable algorithms for finding the minimal groups of cells to be scanned under noiseless and noisy conditions. Also presented are theoretical bounds to the size of these groups, as well as results inter-relating recognition rate, memory capacity and error probability in general scanning systems.

George Washington U., Washington, D. C.
RELIABILITY USING REDUNDANCY CONCEPTS, by Louis Depian and Nelson T. Grisamore. Technical rept. on Contract N7onr-41906. 1 Feb 59, 19p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 145 583

International Business Machines Corp., Poughkeepsie, N. Y.
DESIGN AND ANALYSIS OF HIGH SPEED CIRCUITS. Final rept. for 16 July 58-15 Oct 59 on Contract AF 19(604)4152. [1959] 278p. 4 refs. AFCRC-TR-59-351.
Order from LC mi$11.10, ph$45.60 PB 145 550

General logic requirements of large high speed systems were investigated. Included in Section II is a summary of binary adders, an analysis of the probability distribution of the longest carry sequence, and a general discussion of circuit requirements. Several examples are included which graphically show the effects of fan in and fan out considerations upon delay. The basic circuit configurations, all necessary design equations, a set of typical component values, and a discussion of the circuit operating characteristics are contained in Sections I and III.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ROCKET-MOTOR-PERFORMANCE COMPUTER, by Raymond A. Buchanan. Rept. on Contract DA 04-495-ORD-18. 6 Oct 52, 22p. 3 refs. Memo. no. 20-77.
Order from LC mi$2.70, ph$4.80 PB 145 920

Usual methods of calculating characteristic velocity and mixture ratio for a specific rocket-motor test are time consuming. An electronic analog computer has been built that will compute these motor-performance characteristics and record them while the motor test is in progress. The computer consists of two square-root extracting devices and two divider circuits. Operating experience has proved the outputs of the computer to be accurate within 1.0 per cent of hand computations made from the three computer inputs: fuel-flow, oxidizer-flow, and chamber-pressure recordings. (Author)

Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON THE REALIZABILITY OF AN ALL MAGNETIC COMPUTING SYSTEM, by H. D. Crane. Scientific rept. 1 on Contract AF 19(604)5909. Oct 59, 48p. 3 refs. AFCRC-TN-59-972.
Order from LC mi$3.30, ph$7.80 PB 145 285

This report presents early results of the study of some of the major technical areas concerned in realizing computer logic with all-magnetic circuits. A logical development of the circuit approach as presently conceived is presented. The circuitry of a two-input, three-output module is developed. A system design using approximately 750 such modules is briefly outlined. This system has the capability of five-decimal-digit addition, subtraction, and multiplication under keyboard control. Some initial thoughts on circuit packaging are presented. (Author)

Willow Run Labs., U. of Michigan [Ann Arbor]
A MULTIDIRECTIONAL BINARY-CODE CONVERTER, by Reed E. Maes. Rept. on Proj. Michigan, Contract [DA 36-039-sc-52654] Oct 57, 28p. 2 refs. Rept. no. 2144-154-T; AD-146 030.
Order from LC mi$2.70, ph$4.80 PB 137 524

A discussion is presented of a code converter built to adapt Teletype equipment, Hughes Typotron tubes, and Convair Charactron tubes for use with large-scale data-processing equipment. The converter is bidirectional in operation and can use either Teletype or Flexowriter codes as inputs which makes the 3 remaining codes (Flexowriter or Teletype, and Typotron and Charactron) all available as simultaneous outputs. All the devices use 6-bit binary codes, except the 5-bit Teletype which can develop a 6th bit by storing the letters-shift and figures-shift characters. The 4 codes are listed to show the dissimilarity. To adapt Teletype, Typotron, and Charactron to Midac (Michigan digital automatic computer), the automatic converter was constructed. It has 2 modes of operation; Teletype code is accepted in one and Flexowriter in the other. The principles employed in the development of the converter are outlined. A calculation is made of the converter component values and a mathematical analysis is given of the drive requirements.

MECHANICS

Brown U. Div. of Applied Mathematics, Providence, R. I.
ON FINITE ELASTIC DEFORMATIONS WITH A PERTURBED STRAIN-ENERGY FUNCTION, by A. J. M. Spencer. Technical rept. no. 14, Mar 56-Apr 57, on Application of Invariance Principles in Continuum Mechanics, Contract DA 19-020-ORD-3487. July 57, 30p. 6 refs. DA-4387/14; AD-140 569.
Order from LC mi$2.70, ph$4.80 PB 145 176

In order to obtain analytical solutions to problems involving finite deformations of elastic solids it is often necessary to adopt a specific form for the strain-energy function. In this paper it is supposed that such a strain-energy function W is perturbed to a new strain-energy function $W + \varepsilon W'$, with the result that an additional small deformation is superimposed on the existing finite deformation. Stress-strain relations and equations of equilibrium are formulated which, with suitable boundary conditions and a knowledge of the original finite deformation, make possible the

determination of the displacements and stress-components that are superimposed when W is perturbed. The theory is illustrated by application to the problem of simultaneous extension, inflation and shear of a cylindrical tube, and also to the special case in which the tube undergoes shear only. In the applications W is supposed to have the Mooney form, while W' is an arbitrary function to the strain invariants. (Author)

Brown U. Div. of Engineering, Providence, R. I.
ON THE CONTINUING DEFORMATION OF WORK-HARDENING PLASTIC SOLIDS, by G. R. Cowper. Technical rept. no. 11 on Contract Nonr-562(20). Apr 59, 66p. 18 refs.
Order from LC mi$3.90, ph$10.80 PB 145 392

The boundary value problem for the quasi-static post-yield deformation of a work-hardening plastic body is formulated. The formulation fully accounts for the changes in geometry which accompany the deformation and includes the thermal effects arising from thermal straining and the temperature dependence of the yield stress. As an example, the plane strain deformation of a bar under uniform tension or compression is considered.

Brown U. Div. of Engineering, Providence, R. I.
STRESS WAVES IN SOLIDS, by S. R. Bodner. Technical rept. no. 8 (Final) on Contract Nonr-562(14). Mar 59, 16p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 145 391.

Contents:
Some aspects of the mechanical testing of non-metallic solids, by H. Kolsky
Dispersion effects of stress propagation, by Din-Yu Hsieh
A differential stress-strain relation for the hexagonal close-packed array of elastic spheres, by J. Duffy
An experimental study of pulse propagation in elastic cylinders, by D. Y. Hsieh and H. Kolsky
The validity of model representation for linear viscoelastic behavior, by H. Kolsky and Y. Y. Shi
Stress wave propagation in lead, by S. R. Bodner and H. Kolsky
Fractures produced by stress pulses in glass-like solids, by H. Kolsky and Y. Y. Shi

Illinois Inst. of Tech., Chicago.
PLASTIC ANALYSIS OF ROTATIONALLY SYMMETRIC SHELLS, by Philip G. Hodge, Jr. Rept. on Contract Nonr-140604. Feb 59, 85p. 50 refs. DOMIIT rept. no. 1-6.
Order from LC mi$4.80, ph$13.80 PB 145 269

The theory of limit analysis is presented from the specific viewpoint of rotationally symmetric shells. The general theory is developed in a reasonably self-contained manner. Various yield conditions are derived and compared both as to accuracy and usability. Applications are made to some known problems to illustrate the techniques used in applying the theory and to several new problems. Particular attention is paid to comparing various solutions for a simply supported spherical cap. The paper closes with an indication of some fruitful directions for future research. (Author)

New York U. Coll. of Engineering, N. Y.
STRUCTURAL SIGNIFICANCE OF DUCTILITY, by George Gerard. Status rept. no. 2, 1 Sep-31 Oct 59, on Contract NOas 59-6257c. [1959] 10p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 145 388

The general objectives of this research program are broadly as follows: (1) Investigate the basic aspects of ductility to assess the significance for design purposes of available techniques and conditions of test for ductility. (2) Investigate relations between ductility and maximum strength-weight in typical structural applications. Mechanical strength levels at which uniformity of properties become adversely affected by low ductility are of particular interest.

Polytechnic Inst. of Brooklyn, N. Y.
CREEP ANALYSIS OF HOLLOW SPHERES SUBJECTED TO UNIFORM PRESSURES, by Sharad A. Patel and K. A. V. Pandalai. Rept. on Contract Nonr-839(23). Apr 59, 16p. 7 refs. PIBL rept. no. 488.
Order from LC mi$2.40, ph$3.30 PB 145 708

The creep stress distribution in hollow spheres subjected to uniform internal and external pressure is investigated. The derived closed form solutions yield circumferential stress distributions radically different from those given by the linear elastic theory.

Rensselaer Polytechnic Inst., Troy, N. Y.
COUPLED TORSIONAL AND LONGITUDINAL VIBRATIONS OF A THIN PRISMATIC BAR, by R. C. DiPrima. Rept. on Contracts AF 18(600)1586 and Nonr-1866(02). 27 Feb 58. 14p. 3 refs. RPI MathRep no. 12; AFOSR-TN-58-126; AD-152 153.
Order from LC mi$2.40, ph$3.30 PB 145 547

The effect of pretwist on the natural frequencies of coupled torsional-longitudinal oscillations of thin bars is studied. It is found that the natural frequencies of oscillations which consist primarily of torsional motion may be considerably increased depending upon the thinness of the bar, and the amount of pretwist. The natural frequencies of oscillations which consist primarily of longitudinal motion are not significantly altered. (Author)

Stanford U. Div. of Engineering Mechanics, Calif.
ELASTIC BENDING OF PRETWISTED BARS, by J. N. Goodier and D. S. Griffin. Rept. on Contract Nonr-225(29). 15 Mar 59, 135p. 16 refs. Technical rept. no. 115.
Order from LC mi$6.90, ph$21.30 PB 145 599

It is evident that bars which have a natural twist in the unstressed state -- pretwisted bars -- do not respond to static bending loads in the same way as straight, untwisted bars. Under the action of end couples, the axis of the pretwisted bar will become a space curve. The behavior is influenced both by the varying orientation of the cross section along the bar, and by the helicoidal shape of the boundary. Stress solutions are obtained within the framework of the linear theory of elasticity for bars with a moderate, constant rate of pretwist. The differential equations and boundary conditions are expressed in terms of stress components referred to coordinates coinciding locally with the principal axes of the bar.

Watertown Arsenal Labs., Mass.
BOUNDARY IRREGULARITIES IN PLANE ELASTICITY, by O. L. Bowie. Dec 59, 38p. 5 refs. Technical rept. no. WAL TR-893.6/2.
Order from LC mi$3.00, ph$6.30 PB 145 125

Muskhelishvili's formulation of the plane problem in terms of a single analytic function is extended to an important class of regions involving geometrical irregularities in the boundary shape. The mapping functions which contain branch points to define these irregularities are preserved in their exact form and the solution is set up in terms of corresponding multi-valued forms for the stress function. It is shown by several numerical examples that such a formulation provides for a more basic understanding of the character of the solution. Although it is not possible to establish the precise forms of the mathematical singularities in an a priori manner, the information which is gained by a study of the stress function by the present formulation can be utilized in treating convergence problems in the numerical solution. (Author)

Watertown Arsenal Labs., Mass.
ELASTIC BUCKLING OF AXIALLY COMPRESSED, THIN, UNREINFORCED CYLINDRICAL SHELLS, by J. J. Connor, Jr. Jan 60, 49p. 22 refs. WAL TR 836.32/2.
Order from LC mi$3.30, ph$7.80 PB 145 373

An extensive survey of the literature on the elastic buckling of axially compressed, thin, unreinforced cylindrical shells is presented in this report. The stability of unpressurized cylindrical shells is considered first. Included in the discussion are the "small deflection" solutions, semi-empirical investigations, theoretical analyses of the nonlinear postbuckled behavior, and a general treatment of the classical and finite deflection stability criteria. Then, the theoretical and semi-empirical investigations of axially-compressed pressurized cylindrical shells are described. Finally, design criteria for both pressurized and unpressurized cylindrical shells are presented. Throughout the report, particular emphasis is placed on discussing the validity and limitations of the basic assumptions associated with each investigation. (Author)

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
UNSTEADY AIRLOADS ON POINTED AIRFOILS AND SLENDER BODIES AT HIGH MACH NUMBERS, by Garabed Zartarian. Rept. for 27 Mar 58-29 May 59 on Dynamic Problems in Flight Vehicles, Contract AF 33(616)5651. Dec 59, 113p. 61 refs. WADC Technical rept. 59-583.
Order from OTS $2.50 PB 161 509

Utilizing the piston analogy derived from the hypersonic small-disturbance theory, two approximate methods are found for the determination of airloads on pointed airfoils and slender bodies in unsteady motion at high Mach numbers. The first is an extension of the shock-expansion technique which is applicable for airfoils and certain classes of bodies when the hypersonic similarity parameter $M_\infty \tau$ is sufficiently large. The second is a variational approach, formulated primarily for bodies at moderate values of $M_\infty \tau$. Several numerical examples for simple configurations are presented to clarify both procedures, and are compared with existing solutions. For the variational approach, the cases are confined to those of steady flow, but the necessary steps to cover unsteady flows are indicated. Finally, possible extensions for bodies with more complicated cross-sectional shapes and for wing-body combinations are discussed. Some comments are offered concerning inclusion of real gas effects and the estimation of the airloads in the free-molecule flow regime. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
COMPRESSIBLE FLOW TABLES k=1.26 STAGNATION TEMPERATURE CHANGE WITHOUT FRICTION, by C. Hoebich. Rept. on One-Dimensional Compressible Flow Tables for a Perfect Gas in Mach Number Increments of 0.001 (k=1.26; Stagnation Temperature Change without Friction. Feb 59, 89p. ARGMA TN 1H 1N-2.
Order from LC mi$4.80, ph$13.80 PB 145 502

This report tabulates functions of Mach numbers for compressible perfect gas. The ratio of specific heats k is 1.26. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate time-consuming interpolation. (Author) (See also PB 144 413)

Arnold Engineering Development Center, Tullahoma, Tenn.
DYNAMIC STABILITY TESTS IN HYPERSONIC TUNNELS AND AT LARGE MODEL AMPLITUDES, by C. J. Welsh, R. L. Ledford and others. Rept. on Aro, Inc., Contract AF 40(600)800. Dec 59, 42p. 4 refs. AEDC-TR-59-24; AD-229 516.
Order from LC mi$3.30, ph$7.80 PB 145 295

Results of experimental dynamic stability tests at Mach numbers 5, 7, and 8 of a flared afterbody reentry shape are presented. Measured damping derivatives indicate that dynamic stability testing is feasible at hypersonic speeds and at large model amplitudes. (Author)

Arnold Engineering Development Center, Tullahoma, Tenn.
INVESTIGATION OF A WELDABLE TYPE, HIGH-TEMPERATURE STRAIN GAGE FOR MEASUREMENT OF STRAIN BY ELECTRICAL MEANS AT TEMPERATURES UP TO 600°F, by Guy J. Gardner and Ernest E. Newman. Rept. on ARO, Inc., Contract AF 40(600)800. Jan 60, 30p. AEDC-TN-60-30.
Order from LC mi$2.70, ph$4.80 PB 145 371

The tests indicated that unbonded strain data can be used to predict the apparent strain of bonded gages to within 0.07 to 0.4 micro-in./in./°F for temperatures up to 600°F. Gage factors were found, in general, to be lower than those specified by the manufacturer and to decrease from 2.5 to 7.5 percent with temperature at 600°F.

Bureau of Ordnance, Dept. of the Navy, Washington, D. C.
STABILITY DERIVATIVES FOR SPINNING BODIES OF REVOLUTION IN THE SUPERAERODYNAMIC REGION, by Thomas W. Finch. 1958, 23p. 2 refs. Technical note no. 43; AD-200 178.
Order from LC mi$2.70, ph$4.80 PB 145 398

Recent studies have shown that the mechanism of molecular reflection at low gas densities is closely approximated by the diffuse model in which the gas molecules are considered to strike the surface and rebound in random directions with velocities corresponding to the heat content of the body. The present paper uses this mechanism to obtain stability derivatives for spinning bodies of revolution.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
THE FINITE ASPECT RATIO JET FLAP, by R. A. Hartunian. Rept. on Contract DA 44-177-tc-439. Oct 59, 81p. 28 refs. Rept. no. AI-1190-A-3.
Order from LC mi$4.50, ph$13.80 PB 145 698

The lifting surface equations for the finite aspect ratio jet flapped wing are developed, assuming small perturbations of the undisturbed flow. The lifting surface, in this case, is comprised of the wing and the curved portion of the jet sheet. The governing integro-differential equations are written in a form, analogous to ordinary finite aspect ratio wing theory, which suggests procedures of approximation in terms of the aspect ratio of the lifting surface. The limiting case of large aspect ratio is given detailed consideration.

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
THE LAMINAR BOUNDARY-LAYER FLOW ON ROTATING CYLINDERS. PART II. THIN CYLINDERS, by Shao-Wen Liu. Rept. on Contract AF 18(600)1523. June 57, 116p. 17 refs. AFOSR-TN-57-298; AD-210 156.
Order from LC mi$6.00, ph$18.30 PB 145 479

The boundary-layer equations for a cylindrical blade of small thickness rotating with a constant angular speed about an axis perpendicular to the cylindrical axis are re-examined, and from the existing solutions, an extension is made to allow the axis of rotation to be located arbitrarily with respect to the leading edge of the blade. The cylindrical symmetry is represented by assuming a universal velocity polynomial in terms of the chordwise coordinate for the chordwise potential flow. As in the flat-plate case, solution is obtained by means of series expansions in terms of appropriate parameters. In the present case, series expansion is also made in terms of the chordwise coordinate. The perturbation due to small local taper of the cylinder is also included.

Deutsche Forschungsanstalt für Luftfahrt (Germany).
THEORETICAL AND EXPERIMENTAL CASCADE FLOW INVESTIGATIONS AT HIGH SUBSONIC MACH NUMBERS (PRESSURE DISTRIBUTIONS AND WAKE MEASUREMENTS), by U. Hopkes. Rept. on Contract AF 61(052)105. 26 June 59, 60p. 18 refs. Institut für Aerodynamik rept. no. 59/21; AFOSR-TR-59-45; AD-214 810.
Order from LC mi$3.60, ph$9.30 PB 145 501

Extensive experimental investigations on 2-dimensional cascades at high subsonic Mach numbers were carried out in the variable density high speed cascade wind tunnel. Varying the cascade geometry and the Mach number the following quantities were measured up to the choking Mach number for 2 different blade profiles (NACA 0010 and NACA 8410): (1) pressure distribution on the blade, (2) loss coefficient and (3) deflection of flow and static pressure difference across the cascade. The loss coefficient and the deflection are nearly constant up to the critical Mach number, but the static pressure difference varies with the Mach number. The experimental pressure distributions were compared with different theoretical methods for calculating pressure distributions in compressible flow. (Author)

Georgia Inst. of Tech., Atlanta.
THE COMPUTED INSTANTANEOUS VELOCITIES INDUCED AT THE BLADE AXES BY THE SKEWED HELICAL VORTICES IN THE WAKE OF A LIFTING ROTOR IN FORWARD FLIGHT, by Walter Castles, Jr. and Howard L. Durham, Jr. Rept. on Contract Nonr-991(05). Mar 59, 119p. 7 refs. AD-210 613.
Order from LC mi$6.00, ph$18.30 PB 145 395

The computed instantaneous velocities induced at the blade axes by the skewed helical vortices in the wake of a lifting rotor having 1, 2, 3, or 4 blades and operating in high-speed forward flight. Examples of the application of the results to find the approximate effects of finite number of blades and rotor angular velocity on the induced power required and on the instantaneous blade air loadings. (Author)

Illinois U. Engineering Experiment Station, Urbana.
COMPRESSIBLE NON-ISOENERGETIC TWO-DIMENSIONAL TURBULENT ($Pr_t = 1$) JET MIXING AT CONSTANT PRESSURE: AUXILIARY INTEGRALS, HEAT TRANSFER AND FRICTION COEFFICIENTS FOR FULLY DEVELOPED MIXING PROFILES, by H. H. Korst and W. L. Chow. Rept. on Transonic and Supersonic Flow of a Real Fluid at Abrupt Increases in Cross Section, Contract AF 18(600)392. Jan 59, 19p. 8 refs. ME Technical note 392-4; AFOSR-TR-59-20; AD-211 328.
Order from LC mi$2.40, ph$3.30 PB 145 545

Definitions and graphical presentation of auxiliary functions, calculated on a high speed digital computer (ILLIAC), pertaining to the two-dimensional non-iscenergetic turbulent jet mixing problem. Theoretical friction coefficients and Stanton Numbers for such mixing regions are given. The results facilitate especially the treatment of jet-slipstream interaction (base pressure and base temperature problem). (Author)

Institute of Engineering Research, U. of California, Berkeley.
HEATING RATE CHARACTERISTICS OF AN OXYACETYLENE FLAME APPARATUS FOR SURFACE ABLATION STUDIES, by Edwin Joseph Russ. Master's thesis. Rept. on Contract DA 04-200-ORD-776. 20 Dec 59, 73p. 21 refs. Technical rept. HE-150-176; Series no. 128, issue no. 3.
Order from LC mi$4.50, ph$12.30 PB 145 129

The heating rate characteristics of a surface ablation apparatus were investigated. The apparatus utilized oxyacetylene combustion products for two-dimensional hot gas flow parallel to flat plate specimens. Maximum heating rates were 2.5×10^5 Btu/hr ft^2. The apparatus produces a gas stream with a velocity of approximately 300 ft/sec for heating 3 x 5 inch flat plates. Stream temperatures around 5500° R were measured using the sodium spectral line reversal technique. Heating rates were calorimetrically obtained by measuring the transient temperature rise of a stainless steel flat plate. Rates ranged from 10^5 to 2.5×10^5 Btu/hr ft^2 for plate temperatures of 800° R to 2000°R.

Institute of Engineering Research, U. of California, Berkeley.
LOW DENSITY AERODYNAMIC CHARACTERISTICS OF A CONE AT ANGLE OF ATTACK, by G. J. Maslach and L. Talbot. Rept. on Subcontract to Contract AF 04(647)269. 30 Oct 59, 54p. 7 refs. Rept. no. HE-150-172; Series no. 125, Issue no. 2.
Order from LC mi$3.60, ph$9.30 PB 145 693

The aerodynamic forces and pitching moment acting upon a nine degree half angle cone have been measured and the data are presented in coefficient form for the following supersonic low density flow conditions: M = 5.83, Re/in = 8940; M = 5.55, Re/in = 4370; M = 4.06, Re/in = 2630; M = 3.85, Re/in = 1550. Theoretical estimates of the various boundary layer contributions to the axial force, normal force and pitching moment are defined and sample calculations performed. The experimental results are then compared to Newtonian predictions with appropriate viscous convections. Good agreement is obtained. (Author)

Institute of Engineering Research, U. of California, Berkeley.
OXYGEN RECOMBINATION PROGRAM, by Stuart A. Hoenig. Rept. no. 2 on Contract Nonr-222(45). 23 Mar 59, 46p. 21 refs. Rept. no. HE-150-163; Series no. 20-125.
Order from LC mi$3.30, ph$7.80 PB 145 077

An experimental apparatus has been designed to measure the catalytic properties of various metals toward gaseous recombination. Experiments on a number of pure metals agree in a qualitative manner with the theory. (Author) (See also PB 137 919)

Institute for System Research, U. of Chicago, Ill.
DIGITAL COMPUTATION TECHNIQUES FOR FLUID FIELDS WITH SHOCK, by Francis J. Marshall. Rept. on Flight Dynamics Research and Analysis Services, Contract AF 33(616)2797. Oct 59, 189p. 117 refs. WADC TR-59-535.
Order from OTS $3.00 PB 161 497

The author explores the feasibility of obtaining the aerodynamic forces and moments of a body moving through a fluid by solving theoretical equations on a digital computer. The report reviews the fundamentals of the problem in-the-large and then considers a particular facet of the problem. A very broad background to the continuum-digital computer merger, primarily in terms of fluid dynamics, is provided which includes basic theory and summaries of recent approaches in this domain, most of which depart notably from classical methods. The particular problem selected is that of obtaining the two-dimensional supersonic flow field (excluding wake) of a blunt body with the strong shock wave treated as an interior element. The foredrag as a function of Mach number is one specific element sought. The author concludes that the method described is a valid and practical means of obtaining the foredrag of a two-dimensional blunt body travelling supersonically and of obtaining the details of the flow field outside the shock zone.

Naval Ordnance Lab., White Oak, Md.
COMPUTING OF AERODYNAMIC COEFFICIENTS FROM RAW DATA WITH ANALOG METHODS, by W. A. Menzel. 1 Oct 57, 18p. 1 ref. Aeroballistic Research rept. 392; NAVORD rept. 4532; AD-154 533
Order from LC mi$2.40, ph$3.30 PB 145 354

The algebraic equations for the aerodynamic coefficients are transferred by analog computational methods into equivalent electronic circuits using operational amplifiers. A strain gage balance calibration is described which provides for the initial computer setting and gives an automatic check of the proper computer setting. This method is characterized by its less time consuming procedure and the availability of data in coefficient form immediately after each test run. It has successfully been applied to determine the Magnus coefficient of spinning models. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
THE EFFECT OF CENTRIFUGAL FORCES ON BOUNDARY LAYER TRANSITION FOR A HIGHLY HEATED BODY, by Eugene Sevigny and Marian Visich, Jr. Rept. on Aerodynamic and Heat Transfer Problems in Hypersonic Flow, Contract AF 33(616)6118. Mar 59, 47p. 7 refs. WADC Technical note 59-121; AD-214 620.
Order from LC mi$3.30, ph$7.80 PB 146 105

An experimental program was conducted in the M = 3.75 wind tunnel to determine the effect of centrifugal forces on boundary layer transition for a highly heated body. The model used in this investigation was a hemispherically blunted 20° half-angle cone having a density ratio (external of the boundary layer to wall) of approximately four along the conical region, and a maximum centripetal acceleration at the center line of the model of 300 g's. The free stream Reynolds number per foot range over which the tests were conducted was 22.2 to 51.9 x 10^6.

Polytechnic Inst. of Brooklyn, N. Y.
PRESSURE DISTRIBUTIONS ON A TWO-DIMENSIONAL BLUNT-NOSED BODY AT VARIOUS ANGLES OF ATTACK, by Victor Zakkay and Arthur K. Fields. Rept. on Contract AF 49(638)217. Oct 58, 29p. 5 refs. PIBAL rept. no. 461; AFOSR-TN-58-1016; AD-162 281.
Order from LC mi$3.00, ph$6.30 PB 145 481

Pressure distributions on a two-dimensional blunt-nosed body at angles of attack have been determined at a Mach number of 6.0 in the hypersonic facility of the Polytechnic Institute of Brooklyn Aerodynamics Laboratory. The pressure distribution results and the velocity gradient at the stagnation point are compared with the theoretical predictions. It is shown that the Newtonian theory does not apply for bodies where the sonic point does not fall on the same radius of curvature as the stagnation point. A large reduction in stagnation point heat transfer was obtained as a result of increasing the radius of curvature of the body at the sonic point over that which exists at the stagnation point of constant radius of curvature models

Polytechnic Inst. of Brooklyn, N. Y.
SIMPLE THICKNESS-SHEAR MODES OF VIBRATION IN INFINITE SANDWICH PLATES, by Yi-Yuan Yu. Technical note no. 2 on Contract AF 49(638)453. Oct 58, 19p. 4 refs. AFOSR-TN-58-897; AD-204 132.
Order from LC mi$2.40, ph$3.30 PB 145 480

Closed-form solutions are obtained for simple thickness-shear modes of free vibration of infinite sandwich plates from the exact elasticity theory. The antisymmetric mode is further solved according to the new flexural theory of sandwich plates presented in a companion paper. By matching the lower frequency calculated from the sandwich-plate theory with the corresponding fundamental frequency from the elasticity theory, the value of a shear coefficient in the sandwich-plate theory may be determined directly. It is shown that, for sandwich plates, the shear coefficient is not constant and may have a value very close to unity, in contrast to its constant value of $\pi/12$ for homogeneous plates given by Mindlin.

Polytechnic Inst. of Brooklyn, N. Y.
SOLUTIONS OF SUPERSONIC INTERFERENCE PROBLEMS BY GENERALIZED INTEGRAL RELATIONSHIP: EXAMPLES FOR A CIRCULAR CYLINDRICAL BODY, by Lu Ting. Rept. on Contract AF 18(600)694. Oct 58, 46p. 8 refs. PIBAL rept. no. 465; AFOSR-TN-58-1069; AD-207 229.
Order from LC mi$3.30, ph$7.80 PB 145 482

The generalized integral relationship is employed to solve the interference problem of wings and cylindrical bodies of arbitrary cross section. The procedure is to represent the pressure distribution on the body and the wing inside the interference region by a linear combination of a finite number of elementary functions of the surface variables. The combination fulfills the condition that the pressure is continuous inside the interference region and also across its boundary. The arbitrary constants in the combination are determined by the generalized integral relationship which will be reduced to a set of simultaneous linear algebraic equations.

Polytechnic Inst. of Brooklyn, N. Y.
STUDY OF DRAG REDUCTION OF HIGH-WING CONFIGURATIONS AT SUPERSONIC SPEEDS, by R. Parthasarathy. Rept. on Contract AF 18(600)694. Oct 58, 26p. 4 refs. PIBAL rept. no. 456; AFOSR-TN-58-837; AD-203 001.
Order from LC mi$2.70, ph$4.80 PB 145 566

The possibility of drag reduction of wing-body combinations at all practical values of the lift coefficient, by a proper distribution of the body volume, is explored. This is illustrated by modifying a midwing configuration, composed of a full circular cone, symmetrically disposed about the sweptwing of zero thickness, to a high-wing configuration, composed of the same wing, but two half cones of equal volume as the full cone, mounted beneath the wing. It is found that at M = 3.0 and lift coefficient = 0.1, for a cone of semi-vertex angle $\theta_c = 5°$, the high-wing configuration gives a drag reduction of 16% over that of the corresponding midwing configuration whereas there is found to be a drag reduction of 6.5% at M = $\sqrt{2}$. Similar comparison for the percentage increase in lift drag ratio for the above-mentioned configurations shows a maximum increase of 34% at M = 3.0 for the high-wing configuration over the midwing configuration, whereas it is 22% at M= $\sqrt{2}$. Numerical results

show that the high-wing configuration gives a significant reduction in drag as compared to a midwing configuration of equal volume and furthermore, greater reductions in drag are obtained at higher Mach numbers. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A THEORETICAL INVESTIGATION ON THE USE OF COMBUSTION PRODUCTS FOR THE SIMULATION OF HYPERSONIC FLOW, by Vito D. Agosta. Rept. on Research on the Utilization of the Hypersonic Wind Tunnel, Contract AF 33(616)3978. Mar 59, 31p. 13 refs. WADC Technical note 59-81; AD-211 916.
Order from LC mi$3.00, ph$6.30 PB 146 106

A theoretical investigation has been performed on the use of combustion products for the simulation of hypersonic flow. Condensation limits were determined in order to insure vapor-free flow for various fuel-air combinations. For a particular case investigated (C/O = 0.32; H/O = 0; N/O = 2.57; p_t = 1200 psia; T_t = 3000°R) the ratios of pressures, specific heats, Mach number and Reynolds number closely simulate Mach 7 flight at 100,000 feet altitude in the atmosphere. The influence of scale on pressure distributions and forces, and the influence of viscous effects can be investigated using combustion gases. In addition the cost of equipment employing this technique would be expected to be relatively low. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A REVIEW OF SOME RECENT DEVELOPMENTS IN HYPERSONIC FLOW, by Antonio Ferri. Rept. on Aerodynamic Research, Contract AF 33(616)3265. Sep 58, 88p. 93 refs. WADC Technical note 58-230; AD-155 822.
Order from LC mi$4.80, ph$13.80 PB 146 107

The problems connected with hypersonic flows are reviewed. First, those connected with non-ideal gas behavior are shown to be not of great importance at the present time compared to the lack of information concerning other aspects of hypersonic flow. The problem of pressure distribution on blunt-nosed bodies is discussed and the importance of the sonic line pointed out. The pressure distribution in three-dimensional flows is discussed, for example, the flow about an axially symmetric body at an angle of attack is described. The present status of laminar and turbulent heat transfer calculations for hypersonic conditions is reviewed. The important effects of entropy on boundary layer characteristics are pointed out. In these several problem areas experimental data obtained at PIBAL are presented. (Author)

Technische Hochschule, Karlsruhe (West Germany).
REMARKS ON RING AIRFOIL THEORY, by Johannes Weissinger. Rept. on Contract AF 61(514)1207. Jan 58, 89p. 16 refs. AD-154 127.
Order from LC mi$4.80, ph$13.80 PB 145 330

In this note several disconnected problems are treated. The first paragraphs deal with ring airfoils in (incompressible) potential flow. The circumferential velocity at the ring surface is calculated which is required e.g. for three dimensional boundary layer calculations and for stress analysis. For ring airfoils the pitching moment due to axial forces (e.g. suction force) may be much greater than for plane wings because of the large lever arm; this moment is calculated. The influence of a central body on pressure distribution, lift and pitching moment is investigated; to begin with, the body is assumed to be an infinite circular cylinder with small diameter. Boundary layer effects are studied, in particular drag and separation. In order to obtain results quickly which may be important for the design and which may serve as a basic for the development of more rigorous methods the three-dimensional problems have been highly simplified so that the rough but quick two-dimensional methods of Truckenbrodt could be applied. For all the problems just mentioned numerical results have been evaluated. (Author)

Technische Hochschule, Munich (West Germany).
NUMERICAL INVESTIGATIONS ON THE SOLUTION OF THE NONLINEAR EQUATION OF SUPERSONIC FLOW BY FINITE DIFFERENCE METHODS (PART I), by Gerhard Seegmüller. Technical note no. 10 on Contract AF 61(514)1080. 4 Nov 59, 45p. 12 refs. AFOSR-TN-60-255.
Order from LC mi$3.30, ph$7.80 PB 145 856

This report deals with the method of characteristics in supersonic flow by the numerical way of the mean-value approximation in several variations. Information is given on the type of convergence and on the truncation error in the local case and in the large, when solving the difference equations by iteration. Pure mean-value procedures are described which also converge on the axis of flows with cylindrical symmetry. Furthermore, there is a discussion of how to find the "true solution" by extrapolation. (Author)

University of Southern California. Engineering Center, Los Angeles.
PRELIMINARY RESULTS OF PLASMA HEATING OF HIGH SPEED AIR FLOW, by Raymond L. Chuan. Technical note on Contract AF 18(603)95. 31 July 58, 10p. USCEC rept. 56-203; AFOSR-TN-58-650; AD-162 182.
Order from LC mi$1.80, ph$1.80 PB 138 109

The decay of a plasma formed by a radio-frequency discharge in a supersonic air stream is utilized to heat the latter. Preliminary experiments show the method to be feasible; and a stagnation temperature in the neighborhood of 1200°K is attained in an air-stream at Mach number 3.5. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

Carnegie Inst. of Tech., Pittsburgh, Pa.
ON THE SCATTERING OF WATER WAVES BY A CIRCULAR DISK, by Richard C. MacCamy. Technical rept. no. 30 on Contract AF 49(638)227. Dec 59, 27p. 10 refs. AFOSR-TN-59-1261.
Order from LC mi$2.70, ph$4.80 PB 145 323

The boundary-value problem describing the diffraction of two-dimensional water waves by a dock of finite width has not as yet been solved in explicit fashion. It has however received considerable attention. The general problem of diffraction by surface obstacles was investigated thoroughly by John and later by Peters and Stoker. An existence proof for the finite dock problem, using the calculus of variations was given by Rubin. Finally it was shown by the author that the integral equation approach can be greatly simplified for the dock problem. It is the purpose of this paper to point out that the earlier results can be extended to the three-dimensional problem of diffraction by a circular dock.

David Taylor Model Basin, Washington, D. C.
LINEARIZED THEORY FOR FLOWS ABOUT LIFTING FOILS AT ZERO CAVITATION NUMBER, by M. P. Tulin and M. P. Burkart. Feb 55, 29p. 5 refs. Rept. C-638.
Order from LC mi$2.70, ph$4.80 PB 145 102

A linearized theory is developed for steady, two-dimensional cavity flows about hydrofoil sections at zero cavitation number. The problem of calculating the flow characteristics including the hydrofoil forces and pitching moments is reduced to an equivalent problem of the classical thin airfoil theory. This equivalence is used to investigate the characteristics of hydrofoil shapes of practical importance. In particular, the lift, drag, and pitching moment due to angle of attack and flap deflection are determined. The important effect of hydrofoil shape on the cavitation drag is revealed, and a family of moderately low drag sections is specified. The linearized theory results for the flat plate are shown to be equal to the first-order (in angle of attack) terms of the exact theory results. (Author)

Massachusetts Inst. of Tech., Cambridge.
AEROELASTIC STABILITY OF LIFTING SURFACES IN HIGH-DENSITY FLUIDS, by Charles J. Henry, John Dugundji and Holt Ashley. Rept. on Contract AF 49(638)160. June 58, 55p. 13 refs. Fluid Dynamics Research Group rept. 58-3; OSR Technical note no. 58-626; AD-162 156.
Order from LC mi$3.60, ph$9.30 PB 145 331

The large increases anticipated in speeds of vehicles towed or propelled underwater suggests a re-examination of the problem of stability of flexible lifting surfaces mounted thereon. Experimental and theoretical evidence is assembled which suggests that oscillatory aeroelastic instability (flutter) is very unlikely at the structural-to-fluid mass ratios typical of hydrodynamic operation. It is shown that static instability (divergence) is the more important practical problem but that its occurrence can be predicted with greater confidence. Flutter data obtained in high-density fluids are reviewed, and various sources of inaccuracy in its theoretical prediction are analyzed.

Willow Run Labs., U. of Michigan, Ann Arbor.
NEW EXACT SOLUTIONS OF THE NAVIER-STOKES EQUATIONS, by W. C. Meecham. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 10p. 3 refs. Rept. no. 2144-372-T; AD-213 410.
Order from LC mi$1.80, ph$1.80 PB 145 375

These new, exact, closed-form solutions of the Navier-Stokes equations for incompressible flow and of the hydromagnetic equations for high-conductivity, incompressible flow are a potential aid in understanding many physical phenomena of fundamental importance to combat surveillance. The solutions are two-dimensional and cellular, containing a single-space Fourier component; the spatial behavior is chosen in such a way that the nonlinear inertial term and the pressure term cancel one another, leaving a linear system to be solved. The time behavior of the solutions is quite general. The solutions to the hydromagnetic equations are such that the velocity and the magnetic fields are parallel and decoupled. The velocity behaves as it does in the purely mechanical case, and the magnetic field simply decays in time; there is no source term for the magnetic field in the present treatment. (Author)

METALLURGY

American Potash and Chemical Corp., West Hanover, Mass.
EXPLOSIVE FORGING, by Vasil Philipchuk. Final technical rept. for July 58-Sep 59 on Contract AF 33(600)37751. Oct 59, 68p. AMC Technical rept. 59-7-694.
Order from OTS $1.75 PB 161 457

Explosives were proved feasible for producing close tolerance, one-sided, closed die aluminum alloy forgings for aircraft and missiles. Capital investments for equipment for explosive forging are lower than for conventional forging, but current operating costs are higher.

Birmingham U. [Gt. Brit.]
THE BEHAVIOUR OF GRAIN BOUNDARIES IN METALS IN A TEMPERATURE GRADIENT, by R. W. Cahn and R. W. Lucas. Final technical summary rept. for Oct 56-Oct 59 on Contract AF 61(514)1020. [1959] 45p. 14 refs. AFOSR-TR-59-126; AD-230 161.
Order from LC mi$3.30, ph$7.80 PB 145 664

Grain boundary motion induced by a temperature gradient does not take place in a metal of high purity. It does so only at temperatures within a few degrees of the melting point of the solvent metal. It can occur when appropriate solutes are concentrated at the grain boundary. The "driving force" for migration is always small and surface tension forces, tending to contract a curved boundary, readily mask the effect.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SELECTED REFERENCES ON MAKING HIGH-TEMPERATURE ALLOYS BY POWDER METALLURGY, by Vincent D. Barth. 18 Mar 60, 6p. 33 refs. DMIC memo 47.
Order from OTS $0.50 PB 161 197

These comments are primarily confined to some of the more informative references which are useful as guides in planning refractory alloy production.

Materials Research Lab., Watertown Arsenal, Mass.
TEMPERATURE DEPENDENCE OF THE DEBYE TEMPERATURES OF ALUMINUM, LEAD, AND BETA BRASS BY AN X-RAY METHOD, by D. R. Chipman. Oct 59, 15p. 20 refs. MRL Rept. no. 67; AD-228 367.
Order from LC mi$2.40, ph$3.30 PB 145 355

The temperature dependence of the Debye temperatures of aluminum, lead, and beta brass were determined by measuring the integrated intensity of a high angle X-ray diffraction peak from each of the materials as a function of temperature. Corrections were made for the accompanying changes in density, scattering factor, and Lorentz-polarization factor, as well as for the underlying temperature diffuse scattering peak. In agreement with recent elastic constant measurements, evidence is found for an explicit temperature dependence beyond that resulting from the simple dependence of Debye temperature on volume.

Northwestern Technological Inst., Evanston, Ill.
KINETICS OF SINTERING OF SODIUM CHLORIDE IN THE PRESENCE OF AN INERT GAS, by D. H. Whitmore and J. B. Moser. Rept. on Contract AF 49(638)436. 19 Nov 59, 27p. 23 refs. AFOSR-TN-59-1256; AD-231 157.
Order from LC mi$2.70, ph$4.80 PB 145 644

Direct observations of interfacial growth and the approach of centers between spheres of sodium chloride were made in an argon atmosphere and over a temperature range of 700 to 800°C. A model is presented which considers Stefan flow to occur within a thin boundary layer in the gaseous phase adjacent to the condensing surface, the sintering rate being predominantly governed by the rate at which sodium chloride vapor diffuses through this boundary layer.

Ohio State U. Research Foundation, Columbus.
THE OXIDATION CHARACTERISTICS OF COLUMBIUM ALLOYS, by Gerald Gordon, Coulson Scheuermann, and R. Speiser. Rept. on Contract N6onr-22528. Mar 59, 56p. 29 refs. Technical rept. 467-5.
Order from LC mi$3.60, ph$9.30 PB 145 625

Contents:
Oxidation behavior of columbium-titanium alloys
Oxidation of columbium-titanium-chromium alloys
The oxidation behavior of columbium-zirconium alloys
The oxidation of Cb-Zr-Ti and Cb-Zr-Cr alloys
Oxide morphology
Variation of hardness across oxidized zones
Identification of the various oxide phases

Springfield Armory, Mass.
DETERMINATION OF THE REACTIVITY OF THE ACTIVE CHEMICAL CONSTITUENTS IN CUTTING FLUIDS WITH VARIOUS METALS AND ALLOYS, by L. Krasnor. Edited by Associated Engineers, Inc., under Contract DA 19-020-504-ORD-4800. 30 July 59, 24p. 7 refs. SA-TR16-1057.
Order from LC mi$2.70, ph$4.80 PB 145 377

An analysis was made of the reaction of six different oils upon twelve different metals and alloys. A temperature of 400 F. was maintained for two hours. These oils were made with five separate classes of active chemical ingredients. Results show that there is a positive and substantial chemical effect.

Ferrous Metals

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
THEORETICAL CONSIDERATIONS OF CORROSION AND HYDROGEN EMBRITTLEMENT INHIBITION (REVIEW OF CONTRACT WORK AT RUTGERS UNIVERSITY) by M. Rosenfeld. 12 Jan 60, 25p. Rept. no. CCL-88.
Order from LC mi$2.70, ph$4.80 PB 145 360

The writer proposes that hydrogen embrittlement inhibition is proportional to the fraction of anodic area covered by the inhibitor(s). Inhibition is due to the potential that is set up between the anodic and cathodic adsorbed inhibitor(s) and this potential opposes the corrosion potential.

Rodman Lab., Watertown Arsenal, Mass.
EFFECTS OF LEAD ADDITION ON THE LATHE CUTTING PROCESS, by Roy Mennell and Fenton L. Bagley, Jr. Oct 59, 25p. 22 refs. Rept. no. RPL-23/8.
Order from LC mi$2.70, ph$4.80 PB 145 379

The effects of lead on the cutting mechanism were revealed only below a critical speed, which was found to decrease for increased workpiece hardness and feed. The lead additive acting as a lubricant on the tool chip interface satisfactorily explains the effects of lead addition below the critical speed.

Watertown Arsenal Labs., Mass.
LOW TEMPERATURE TENSILE-HARDNESS CORRELATIONS OF SAE 4340 STEEL, by John Nunes and Frank R. Larson. Feb 60, 19p. 8 refs. Technical rept. no. WAL TR-320.4/1.
Order from OTS $0.50 PB 161 467

Vickers hardness (DPH) and tensile strength (UTS) were studied on one heat of SAE 4340 steel as a function of testing temperature. It was found that these two variables (DPH and UTS) are linear with respect to the reciprocal absolute temperature. It is possible to derive some simple empirical equations for calculating approximate values of DPH or UTS in the temperature range studied.

Watertown Arsenal Labs., Mass.
MULTIPLE BLOW TRANSITION IN CHARPY TESTING, by George M. Orner and Carl E. Hartbower. Nov 59, 16p. 8 refs. Technical rept. no. WAL TR 112/87-8; AD-228 452.
Order from LC mi$2.40, ph$3.30 PB 145 527

Investigations using a multiple-blow technique in Charpy impact testing, have demonstrated an abrupt inflection in the low-energy range of the energy-to-propagate transition curve. It was desired to determine the effect of variations in the magnitude of low-blow on the transition temperature.

Light Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
RECENT DEVELOPMENTS IN TITANIUM BRAZING, by G. E. Faulkner and W. J. Lewis. 4 Mar 60, 8p. 4 refs. DMIC memo. 45.
Order from OTS $0.50 PB 161 195

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
FATIGUE BEHAVIOR OF 2014-T6, 7075-T6 AND 7079-T6 ALUMINUM ALLOY REGULAR HAND FORGINGS, by D. A. Paul (Kaiser Aluminum and Chemical Corp.) and D. Y. Wang. Rept. for Feb 58-Aug 59 on Materials Analysis and Evaluation Techniques. Jan 60, 34p. WADC Technical rept. 59-591.
Order from OTS $1.00 PB 161 500

This report presents the test procedures and results of a fatigue investigation on regular hand forgings of the aluminum alloys 2014-T6, 7075-T6 and 7079-T6. The effects of forging direction on fatigue strength are investigated in the unnotched and notched condition. The unnotched fatigue strength of the three alloys ranged from 20,000 psi at 2×10^7 cycles, with the 7079-T6 alloy being slightly lower than 7075-T6 and about the same as that of the 2014-T6 alloy. The fatigue strength in the short transverse direction is consistently lower than in the longitudinal direction; however, the difference becomes less in the notched condition. (Author)

Metals Research Lab., Brown U., Providence, R. I.
THE USE OF ULTRASONIC METHODS TO DETERMINE FATIGUE EFFECTS IN METALS, by Rohn Truell, Bruce Chick and others. Rept. for 16 June 58-15 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5884. Nov 59, 24p. 1 ref. WADC Technical rept. 59-389; AD-226 098.
Order from OTS $0.75 PB 161 487

An investigation was made to detect and follow physical changes in materials, primarily Al, during stress cycling by means of high frequency ultrasonic attenuation and velocity measurements. A discussion is presented of observed changes in ultrasonic attenuation and velocity in commercially pure 1100 Al (Alcoa) when subjected to slow continued stress cycling (1 to 6000 c) and a delayed recovery phenomenon that appeared when the cycling was interrupted. The development of an automatic instrument to measure and record ultrasonic attentuation changes is also discussed.

Michigan U. Research Inst., Ann Arbor.
EFFECT OF PRIOR CREEP ON THE MECHANICAL PROPERTIES OF A HIGH-STRENGTH HEAT-TREATABLE TITANIUM ALLOY, Ti-16V-2.5Al, by Jeremy V. Gluck and James W. Freeman. Rept. for 8 July 58-31 Mar 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3368. Nov 59, 76p. 6 refs. WADC Technical rept. 59-454.
Order from OTS $2.00 PB 161 490

The effect of creep to 2 percent in 10 or 100 hours at temperatures from 600° to 900°F was determined on the tension, compression, and tension-impact properties of Ti-16V-2.5Al at room temperature or the exposure temperature. Prior creep at 600°F raised ultimate tensile and yield strength. Lesser changes were found at higher temperatures. Changes in properties are attributed to a combustion of stress-accelerated age-strengthening and a Bauschinger effect. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
RESIDUAL STRESSES IN WELDED TITANIUM PLATES, by E. F. Nippes and W. F. Savage. Final technical rept. on Contract DA 20-089-ORD-36696. Nov 57, 45p. 3 refs. AD-148 171.
Order from LC mi$3.30, ph$7.80 PB 145 367

The magnitude and type of residual stresses in welded titanium plates were determined by the subdivision technique employing electrical resistance strain gages. Commercially pure titanium plate and 7%-manganese titanium alloy plate, 5/8-in. thick, were investigated, welded in both cases with commercially pure titanium filler wire utilizing the inert-gas consumable arc process.

Nonferrous (except light) Metals

Rice Inst., Houston, Tex.
STEADY-STATE CREEP OF TIN NEAR THE MELTING POINT, by W. A. Zama, D. D. Lang, and F. R. Brotzen. Technical rept. no. 1 (Final) on Contract DA 23-072-ORD-1167. 15 Oct 59, 33p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 368

The steady-state creep rates of commercial tin were investigated at temperatures between 180 and 230°C. At temperatures below 215°C results indicate that the steady-state creep process is one governed by a single activation energy of 22,500 cal/mol. At higher temperatures, however, the simple Arrhenius-type equation cannot properly express the creep behavior.

Springfield Armory, Mass.
COLUMBIUM AS A HIGH TEMPERATURE STRUCTURAL MATERIAL, by E. H. Abbe. 3 June 59, 25p. 3 refs. SA-TR19-1207.
Order from LC mi$2.70, ph$4.80 PB 145 530

An investigation was made to determine the influence of oxygen in the strengthening and hardening of columbium at both elevated and room temperatures, results of metallurgical examination, X-ray diffraction studies, and hardness tests of sintered and compacted columbium specimens which had been impregnated with various amounts of oxygen are discussed. Increments of added oxygen diffused inwardly through the sintered and compacted metal will strengthen it in essentially a linear manner.

Temple U., Philadelphia, Pa.
EFFECTS OF TEMPERATURE AND COLD WORK ON OPTICAL PROPERTIES OF METALS AND ALLOYS, by L. Muldawer. Final rept. on Contract AF 49(638)73. 15 Oct 58, 26p. 27 refs. AFOSR-TR-58-140; AD-204 553.
Order from LC mi$2.10, ph$4.80 PB 137 954

Alloys similar in character to β-brass have been studied with respect to spectral reflectivity and color as a function of temperature and surface treatment. Large changes in reflectivity edge position and color were observed for changes in temperature; a tendency toward edge disappearance was observed upon cold working. Alloys which are basically face-centered cubic do not show these properties. Electron and x-ray diffraction studies indicate stress induced phase transformations in many of the alloys of the β-brass type. (Author)

Structural Metallurgy and Corrosion

Case Inst. of Tech., Cleveland, Ohio.
HYDROGEN EMBRITTLEMENT IN TERMS OF MODERN THEORY OF FRACTURE, by P. A. Blanchard and A. R. Troiano. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)6419. Aug 59, 31p. 18 refs. WADC Technical rept. 59-444.
Order from OTS $1.00 PB 161 531

An attempt was made to apply Cottrell's theory of brittle fracture to hydrogen embrittlement. A tentative explanation was given to the fact that only transition metals have been thus far embrittled by hydrogen. The influence of the composition of nickel base alloys on their susceptability to hydrogen embrittlement was discussed with the help of some previous and new experimental results. (Author)

Case Inst. of Tech., Cleveland, Ohio.
THE LOWER CRITICAL STRESS FOR DELAYED FAILURE, by E. A. Steigerwald, F. W. Schaller, and A. R. Troiano. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)6419. Aug 59, 36p. 21 refs. WADC Technical rept. 59-445.
Order from OTS $1.00 PB 161 532

The lower critical stress was defined as the minimum stress necessary to produce the critical amount of hydrogen segregation required for crack initiation. A distribution law involving hydrogen concentration, applied stress, and temperature was assumed. On the basis of this law, the observed changes in the lower critical stress as a function of notch acuity, yield strength, temperature, and initial hydrogen content were explained for a significant range of these variables. (Author)

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
STUDY OF A NEWLY DEVELOPED INHIBITOR FOR ETHYLENE GLYCOL IN STORAGE, by Charles B. Jordan. 28 Dec 59, 15p. 4 refs. CCL #86.
Order from LC mi$2.40, ph$3.30 PB 145 683

The object of this study is to show the effect of inhibited ethylene glycol on unlacquered tin-coated steel. Inhibitors involved in the study were a newly developed sodium tetraborate/propylene glycol condensate, borax, and mercaptobenzothiazole. Diluted and undiluted ehtylene glycol was studied. Tin-Coated steel panels were immersed in solutions contained in test jars at room temperature. Inspections were made after 2, 4, 6 and 8 months. It appears that ethylene glycol can be stored in metal containers using MBT in the inhibitor systems providing some of the new condensate forms a part of the inhibitor system. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
CURRENT TESTS FOR EVALUATING FRACTURE TOUGHNESS OF SHEET METALS AT HIGH STRENGTH LEVELS, by J. E. Campbell and W. P. Achbach. Rept. on Contract AF 18(600)1375. 28 Jan 60, 71p. 40 refs. DMIC rept. 124.
Order from OTS $2.00 PB 151 081

In attempting to overcome the brittle fracture problem in solid propellant rocket cases, a number of investigators have developed special tests to measure the fracture toughness of high-strength sheet metals. None of the standard tests are suitable, and the tests that have been used in brittle fracture studies of shipplate and landing-gear steels could not be used for high-strength sheet. A review of the tests that were developed for high-strength sheet metals is presented. These tests involve tensile loading of notched specimens; bending of flat and notched specimens; impact loading of notched specimens; bulging of unnotched, notched, and welded specimens; and combinations of tensile loading and internal pressuring of cylindrical specimens. None of these has been recognized as a standard test and correlation of test data with pressure-vessel performance is very limited. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
METHODS FOR CONDUCTING SHORT-TIME TENSILE, CREEP, AND CREEP-RUPTURE TESTS UNDER CONDITIONS OF RAPID HEATING, by Donald P. Moon and Ward F. Simmons. Rept. on Contract AF 18(600)1375. 28 Dec 59, 43p. 68 refs. DMIC rept. 121.
Order from OTS $1.25 PB 151 078

This report reviews the equipment and testing methods used by 15 different organizations in the tensile and short-time creep testing of materials under conditions of rapid heating. Special attention is devoted to specimen design, method of heating, and the measurement of temperature, load, and strain during the test. ASTM-recommended practices are cited and relative merits of alternative techniques are discussed. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STRUCTURAL DAMAGE IN THERMALLY CYCLED RENE 41 AND ASTROLOGY SHEET MATERIALS, by D. P. Moon, J. A. VanEcho and others. Rept. on Contract AF 18(600)1375. 29 Feb 50, 27p. DMIC rept. 126.
Order from OTS $0.75 PB 151 083

Stress-rupture life at 1650 F and tensile properties at room temperature and at 1400 F were used to determine the extent of structural damage in thermally cycled René 41 and Astroloy sheet materials. Solution-treated and aged René 41 was tested both in the heat-treated condition and after exposure to 10 or 100 thermal cycles between 1350 F and 1750 or 1875 F. All of the conditions of thermal-cycling exposure caused at least some loss in the strength of this material. Metallographic examination indicated that overaging was primarily responsible for the damage at 1750 F, and resolution of the $Ni_3(Al, Ti)$ precipitate and depletion of the alloy by surface oxidation were the damaging mechanisms at 1875 F. Solution-treated and aged Astroloy was evaluated in the same manner in the heat-treated condition and after 10 thermal cycles between 1350 F and 1875 F. No loss of strength was incurred by this exposure, but overaging had taken place and would probably have caused structural damage with further exposure. (Author)

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
FOUNDRY TECHNIQUES. Summary rept. no. 1 on Contracts AF 33(616)3892 and AF 04(645)09. Oct 57, 51p. 21 refs. Rept. R-154; AD-155 405.
Order from LC mi$3.60, ph$9.30 PB 146 125

Techniques are presented which permit production of high-strength - high-ductility 356 aluminum alloy castings. The high-strength - high ductility castings may be cast and heat treated to possess minimum mechanical properties as high as 38,000 psi tensile strength, 28,000 psi yield strength, 6 percent elongation. Application of the techniques to specific intricate castings is described. Foundary procedures used in making the castings are outlined and mechanical properties obtained from test bars cut from the castings are presented.

Martin Co., Baltimore, Md.
DEVELOPMENT AND EVALUATION OF STRUCTURAL BERYLLIUM, by C. J. Giemza. Final rept. for 1 May 58-30 Apr 59 on Contract AF 33(616)5180. Apr 59, 70p. 30 refs. WADC Technical rept. 59-349.
Order from OTS $1.75 PB 161 507

Three major problems have been studied: (1) the development of a process for fabricating structural beryllium sheet to the requirements of airframe applications; (2) the evaluation of its mechanical properties and characteristic behavior to establish its structural merit; and (3) the fabrication of a box-beam structure and a preliminary experimental and analytical qualification of its structural behavior. The goals posed by these problems have been achieved by: defining requirements for structural beryllium sheet, developing a fabrication process, and evaluating fabrication parameters, mechanical properties, and structural characteristics. The comprehensive body of data which has been accumulated will provide a basis for additional study of a broad range of topics, including fundamental behavior, sheet fabrication, forging, forming, design, and testing. (Author) (See also PB 151 263)

Materials Research Corp., Yonkers, N. Y.
THE INVESTIGATION OF THE MECHANISM OF SUBSTRUCTURAL FORMATION IN REFRACTORY METALS AND THE RELATION TO THE OBSERVED MECHANICAL PROPERTIES, by A. Iannucci, J. Intrater and others. Rept. for 15 June 58-15 June 59 on Metallic Materials, Contract AF 33(616)5908. Jan 60, 32p. 3 refs. WADC Technical rept. 59-441, Pt. I.
Order from OTS $1.00 PB 161 489

The formation of substructure in molybdenum as a function of prestrain and polygonization anneal temperature has been demonstrated by metallographic and x-ray techniques. The x-ray diffraction line width is markedly increased by the presence of substructure. In both polycrystalline and single crystal creep tests the creep resistance increased as a function of prestain. In single crystal tests the creep resistance decreased with increased polygonization anneal time. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
OBSERVATIONS ON DIFFUSION IN THE IRON-CHROMIUM SYSTEM, by H. W. Paxton, E. J. Pasierb and T. Kunitake. Technical rept. on Contract Nonr-760(08). 1 Mar 59, 22p. 33 refs.
Order from LC mi$2.70, ph$4.80 PB 145 394

Measurements of self diffusion of chromium using the isotope Cr^{51} in the iron-chromium system from 30 to 100% chromium have been made by autoradiographic techniques at 1275°C.

Naval Engineering Experiment Station, Annapolis, Md.
INVESTIGATION OF CORROSION MECHANISMS IN IDLE BOILERS AND CONDENSATE SYSTEMS, by Frank E. Clarke and A. J. Ristaino. 28 Apr 58. 54p. Research and Development rept. 610314A; AD-204 405.
Order from LC mi$3.60, ph$9.30 PB 145 357

Among factors that contribute to corrosion in idle boilers are partially filled tubes and conventional boiler water treatment chemicals in presently prescribed concentrations which tend to localize attack rather than to prevent it completely in partially filled ferrous containers. Sodium nitrite appears to be the most promising chemical inhibitor of corrosion in idle boilers.

Naval Engineering Experiment Station, Annapolis, Md.
RESISTANCE OF COPPER-NICKEL ALLOYS TO CORROSION BY JP-5 FUEL, by T. N. Cornish and C. L. Brown. 25 Sep 57, 7p. 6 refs. Research and Development rept. 070444A; AD-147 464.
Order from LC mi$1.80, ph$1.80 PB 145 358

Corrosion studies were made of attack by JP-5 jet fuel on 70-30 and 90-10 copper-nickel alloys. Both copper-nickel alloys showed some corrosive attack with the fuels tested. The West Coast fuel appeared to be somewhat less corrosive than the other two fuels. 70-30 copper-nickel was less susceptible to attack.

Rock Island Arsenal Lab., Ill.
DEVELOPMENT OF AN INTERNAL PRESERVATIVE OIL FOR MACHINE TOOLS, by R. LeMar. 24 Nov 59, 32p. 5 refs. Rept. no. 59-3003.
Order from LC mi$3.00, ph$6.30 PB 145 115

Experimental work was carried out to develop oil formulations whose corrosion preventive properties approached those of Military Specification MIL-C-14201A, Grade 1, "Corrosion Preventive, Soft-Film, Cold Application", and would be suitable as an internal preservative for machine tools. A number of accelerated corrosion tests were evaluated to find methods suitable for the reasonably rapid testing of highly inhibited, heavy, long-term preservative oils. In the course of these tests it was shown that cyclic accelerated corrosion tests can show very poor performance characteristics for oils that perform well in constant temperature and constant humidity tests. These test results on the RIA blends provided a basis for the preparation of a list of test methods and requirements to define the proposed long-term internal preservative oil for machine tools.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Admiral Corp., Chicago, Ill.
EVALUATION-DEVELOPMENT OF MIL-C-14157 CAPACITORS FOR NUCLEAR RADIATION ENVIRONMENT, by E. R. Pfaff. Scientific rept. no. 1 on Contract NObsr-77612. 22 Oct 59, 23p.
Order from LC mi$2.70, ph$4.80 PB 145 207

The experimental procedures being employed for evaluating the radiation damage to the CPM-08 capacitors are discussed. The radiation environment is produced by a 20,000 curie cobalt-60 source. The capacitors are to be subjected to gamma fields of approximately 10^5R/hr. for 1000 hours. Initial tests show that the kraft dielectric tissue becomes brittle and gas evolution is associated with the mineral oil impregnant. (Author)

Armour Research Foundation, Chicago, Ill.
REVIEW OF RADIATION CHEMISTRY PAPERS PRESENTED AT THE 2ND GENEVA CONFERENCE, by P. Y. Feng. Rept. on Contract AF 18(603)121. [1959] 41p. 34 refs. AFOSR-TN-59-36; AD-213 865.
Order from LC mi$3.30, ph$7.80 PB 145 655

This review is a condensation of the papers presented for oral presentation at the Radiation Chemistry sessions (C-12 and C-13) of the Second UN Conference on the Peaceful Uses of Atomic Energy held at Geneva, Switzerland, in September 1958. It includes topics on elementary processes, detection of intermediates, irradiation facilities, aqueous systems, organic systems, polymers, catalysts, as well as the reactions of hot atoms.

Diamond Ordnance Fuze Labs., Washington, D. C
EFFECTS OF SPECTRUM ON NEUTRON RADIATION DAMAGE IN SOLIDS, by John S. Wicklund. 15 Dec 59, 15p. 3 refs. TR-803.
Order from LC mi$2.40, ph$3.30 PB 145 359

This paper treats the effects of a variety of spectra, develops a method for comparing spectra in terms of radiation damage in solids, and derives expressions for neutron damage as a function of time and neutron energy.

Michigan U. Research Inst., Ann Arbor.
GEOMETRICAL CORRECTIONS IN DIRECTIONAL CORRELATION EXPERIMENTS, by R. G. Arne, R. E. Sund, and M. L. Wiedenbeck. Technical rept. to 1 Jan 59 on Investigation of Nuclear-Energy Levels, Contract Nonr-1224(13). Feb 59, 13p. 6 refs. 2375-4-T; AD-217 467.
Order from LC mi$2.40, ph$3.30 PB 145 792

The relationship between the point-point angular correlation, $W(\theta)=\sum_l A_l P_l(\cos\theta)$, and the measured correlation function, $W(\theta)=\sum_l A_l' P_l(\cos\theta)$, has

been discussed by Feingold and Frankel for finite detectors of arbitrary shape and efficiency. Their results are applied to the special case of gamma-gamma angular correlation experiments with cylindrical scintillation detectors and axially extended sources. The inherent limitations of the method and effect of detector shielding are discussed. The resulting correction factors have been determined for various energies and configurations and verified experimentally. (Author) This report also refers to 7 articles published in Physical Review or Physical Review Letters.

Elementary Particles

Army Chemical Warfare Labs., Army Chemical Center, Md.
AN EXPERIMENTAL STUDY OF THE INDUCTION OF GAMMA-EMITTING ACTIVITIES IN SEVERAL AMERICAN SOILS BY NEUTRONS OF VARIOUS ENERGIES, by John H. McNeilly and Eugene Eichler. Sep 59, 27p. 9 refs. CWLR-2299; AD-226 908.
Order from LC mi$2.70, ph$4.80 PB 145 634

This report describes experiments to determine the important gamma-emitting nuclides which are formed in soils by neutrons of various energies. It was found that the radiative capture of thermal neutrons was the predominant reaction and the important nuclides formed are Al^{28}, Mn^{56}, and Na^{24}. (Author)

Cambridge U. (Gt. Brit.)
DISPERSION RELATION PREDICTIONS FOR π, p SCATTERING, by T. D. Spearman. Scientific note no. 1 on Contract AF 61(052)233. Oct 59, 6p. 12 refs. AFOSR-TN-59-1313.
Order from LC mi$1.80, ph$1.80 PB 145 682

The dispersion relations for forward elastic π-p scattering are used to calculate the real parts of the forward scattering amplitude. It is found that using more accurate experimental data, the discrepancy observed by Puppi and Stanghellini can be resolved. A more precise value for the renormalized π, N coupling constant is predicted. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
UPPER BOUNDS ON SCATTERING LENGTHS WHEN COMPOSITE BOUND STATES EXIST, by L. Rosenberg, L. Spruch, and T. F. O'Malley. Rept. on Contract AF 19(604)4555. Oct 59, 34p. 21 refs. Research rept. no. CX-44; AFCRC-TN-59-604.
Order from LC mi$3.00, ph$6.30 PB 145 293

In the case of the zero energy scattering of one compound system by another, where one real scattering length completely characterizes the problem, (e.g., the reaction A+B→C+D, in addition to A+B→A+B, cannot take place) it has previously been shown that the Kohn-Hulthén variational principle provides an upper bound on the scattering length if no composite bound states exist. The extension of this result to the case where one or more composite bound states do exist is presented here. The inclusion of tensor forces, exchange forces, and Coulomb forces is allowed. Several methods are given for obtaining a rigorous upper bound on the scattering length, which involve the addition of certain positive terms to the Kohn-Hulthen variational expression.

Lawrence Radiation Lab., U. of California, Berkeley.
NOTE ON THE K-MESON NUCLEON INTERACTION, by Robert Karplus, Leroy Kerth, and Thaddeus Kycia. Rept. on Contract AF 49(638)327. [1959] 11p. 12 refs. AFOSR-TN-59-677.
Order from LC mi$2.40, ph$3.30 PB 145 577

Maryland U., College Park.
HIGH ORBITAL S-STATE CAPTURE OF π-MESONS BY PROTONS, by T. B. Day, G. A. Snow and J. Sucher. Rept. on Contracts AF 49(638)24 and AT(40-1)2504. Dec 59, 9p. 10 refs. Physics Dept. Technical rept. no. 159; AFOSR-TN-59-1295.
Order from LC mi$1.80, ph$1.80 PB 145 643

Maryland U., College Park.
$|\Delta I = 1/2$ - RULE AND THE WEAK FOUR-FERMION INTERACTION, by S. Oneda, J. C. Pati, and B. Sakita (U. of Wisconsin). Dec 59, 11p. 19 refs. Physics Dept. Technical rept. no. 160; AFOSR-TN-60-12; AD 230 873.
Order from LC mi$2.40, ph$3.30 PB 145 511

New York U. Coll. of Engineering, N. Y.
ELASTIC SCATTERING OF ELECTRONS BY ATOMIC HYDROGEN, by Benjamin Bederson, Jacob M. Hammer, and Herbert Malamud. Technical rept. no. 2 on Electron Scattering Project, Nonr-285(15). 1 Jan 58, 85p. 45 refs. AD-154 792.
Order from LC mi$4.80, ph$13.80 PB 137 950

An atomic beam method has been used to perform measurements on the total scattering cross sections of electrons by atomic hydrogen for electron energies between 1.5 and 14.5 e.v. An $H_1 + H_2$ beam is produced by an RF discharge and an electron beam is produced by an electrostatically focused gun. The $H_1 + H_2$ beam is mechanically chopped (25 cps) and is made to cross the electron beam in the scattering region. The scattered electrons are collected by a Faraday chamber and the observed signal recorded by a phase sensitive detection system. Absolute values for the atomic cross sections are obtained by normalizing to the known molecular cross sections.

Uppsala U. (Sweden).
$A_{\Lambda}H^4$ HYPERFRAGMENT EMITTED FROM AN ANTIPROTON CAPTURE STAR, by A. G. Ekspong, A. Frisk, and B. E. Ronne. Technical note no. 4 on Contract AF 61(052)13, phase D. [1959] 10p. 12 refs. AFOSR-TN-59-842.
Order from LC mi$1.80, ph$1.80 PB 145 676

The observation of a definite case of Λ hyperon emission from an antiproton annihilation in a heavy nucleus in nuclear emulsion is reported. The emulsion stack was exposed to a beam of 740 MeV/c antiprotons at the Bevatron. The Λ hyperon is emitted bound in a Λ H^4 hyperfragment. From observational data we calculate a Λ binding energy of 2.6 ± 1.0 MeV. (Author)

Weizmann Inst. of Science (Israel).
MONTE-CARLO CALCULATION OF MESON PRODUCTION IN NUCLEAR REACTIONS. PART I: N-N COLLISIONS AT 100 BEV REGION, by Uri Maor and Gideon Yekutieli. Technical scientific note no. 1 on Contract AF 61(052)58. [1959] 13p. 7 refs. AFCRC-TN-59-433.
Order from LC mi$2.40, ph$3.30 PB 145 689

The two known models of nucleon-nucleus reaction: the nuclear cascade and the "tunnel" models are good approximation at low and at extremely high energies respectively. A third model of nucleon-nucleus reaction "the cascade of excited nucleons" is proposed for the intermediate energy range 25-250 Bev.

Yale U., New Haven, Conn.
ELECTRIC POLARIZABILITY OF THE NEUTRON, by G. Breit and M. L. Rustigi. Rept. on Contract AF 18(600)771. 3 Dec 58, 25p. 7 refs. AFOSR-TN-58-1063; AD-207 223.
Order from LC mi$2.70, ph$4.80 PB 138 352

In connection with a proposed explanation of the anisotropy observed in the scattering of neutrons from various elements at energies of a few hundred kev the order of magnitude of the neutron polarizability is estimated making use of data on photopion production.

Instruments and Installations

Army Chemical Warfare Labs., Army Chemical Center, Md.
DESCRIPTION AND OPERATION OF CHEMICAL CORPS HELICOPTER-TO-GROUND AERIAL SURVEY INSTRUMENT, by Michael J. Schumchyk, John P. Johnson, and John R. Lapic. Sep 59, 27p. 8 refs. CWL Special pub. 3-7; AD-225 266.
Order from LC mi$2.70, ph$4.80 PB 145 272

A helicopter-to-ground aerial radiological survey instrument and its operation are described. The instrument consists of a radiation detector mounted in a tripod connected by a four-conductor cable to an indicating meter through a powered reel. While the helicopter hovers several hundred feet in the air, the radiation detector can be positioned 3 ft above the ground. This instrument is especially suitable for an accurate point survey of radiation fields where survey by ground crews is impractical either because of excessive dose rates in the area or because of inaccessible terrain features. (Author)

Lamont Geological Observatory, Palisades, N. Y.
EXTENSION OF TECHNIQUE FOR NATURAL TRITIUM MEASUREMENTS, by Wallace S. Broecker. Final rept. on Contract AF 19(604)4076. 8 Dec 59, 26p. AFCRC-TR-59-402.
Order from LC mi$2.70, ph$4.80 PB 145 654

An attempt has been made to define the sources and time variations in the natural background of large volume proportional counters in order that more sensitive counters might be constructed for the tritium assay of natural waters.

Radioactivity

Naval Radiological Defense Lab., San Francisco, Calif.
THEORY OF DECONTAMINATION, PART I, by C. F. Miller. 15 July 58, 128p. 13 refs. Research and development technical rept. USNRDL-460.
Order from LC mi$6.30, ph$19.80 PB 146 263

The available concepts of contamination by and decontamination of fallout resulting from nuclear detonations at sea, on land, and over harbors are reviewed; and theoretical equations describing the important chemical interactions with surfaces are summarized, and others are newly developed. The theoretical equations are fitted to and compared with applicable experimental data. The theory can be used as an aid in planning decontamination experiments as well as in interpreting decontamination data from field tests, since it designates the important variables on which the decontamination results depend. These variables include (1) the initial level of contamination, (2) the surface contaminated, (3) the decontamination method, (4) the environmental materials at the point of detonation, (5) the composition of the radioactive sources in the fallout, and (6) the yield and constituents of the bomb. Practical uses of the theory is illustrated by the interpretation of data from several decontamination experiments. The intent of the reported theory is to establish a basis for application of consistent scientific methods in experimental decontamination investigations and in interpretation of data in the field. The state of available literature on the subject is a clear indication that guides to a scientific approach are needed. (Author)

Naval Research Lab., Washington, D. C.
CALCULATION OF ABSORBED DOSE, by C. H. Cheek and V. J. Linnenbom. 24 Feb 60, 34p. 15 refs. NRL rept. 5448.
Order from OTS $1.00 PB 161 259

Equations and tabular data are presented for calculating the absorbed dose in rads when the field conditions of exposure to radiation are known. The elements considered here are those most commonly found in low-Z organic materials, such as plastics, elastomers, lubricants, and insulating materials. The types of radiation considered are gamma radiation, fast monoergic electron beams, and neutrons having a spectrum of energies. Examples are included to illustrate application of the formulas. (Author)

Technical Operations, Inc. [Arlington, Mass.]
SCATTERING OF GAMMA RAYS NEAR AN INTERFACE, by Eric T. Clarke and Paul L. Richards. Rept. on Contract AF 29(601)178. July 57, 58p. 4 refs. TOI 57-16; AFSWC-TR-57-3; AD-96 304.
Order from LC mi$3.60, ph$9.30 PB 146 128

Scintillation counter measurements of gamma ray flux from sources of Na-24, Co-60, and Au-198 immersed in water are reported. Data are presented showing variation in flux with depth of source and of detector for separation distances up to 20 mean free paths in water. It is shown that near the surface the predominant source of gamma rays is air scatter, particularly at large separation distances. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE USE OF COLORED FILTER GOGGLES FOR PROTECTION AGAINST FLASH BLINDNESS, by John Lott Brown. 22 Oct 59, 32p. 6 refs. NADC-MA-5917; BuMed Proj. MR005.13-6002.1, R-19; BuAer Proj. TED ADC AE-5210.
Order from LC mi$3.00, ph$6.30 PB 145 128

The times required for the resolution of parallel line grating test patterns displayed at various luminance levels up to 10^4 foot-lamberts were determined following exposure to an intense adapting flash (12,500, 50,000, or 100,000 foot lamberts) of one second duration. Two gratings were used which required visual acuities of 0.13 and 0.33. The effect of viewing the adapting flash alone or both the adapting flash and the test flash through selective colored filters on the resolution was also determined. The resolution time was found to vary directly with the luminance level of the adapting flash and inversely with the luminance level of the display test pattern and dominant wavelength of the selective color filters. Under all conditions of adapting and testing used, the resolution time appeared to approach an asymptote of about 1/2 second. (Author)

Psychometric Lab., U. of North Carolina, Chapel Hill.
DEVELOPMENT OF SUITABLE RATING SCALES FOR MEASURING THE SUBJECTIVE REACTIONS OF TROOPS USING QM ITEMS UNDER ACTUAL FIELD TEST CONDITIONS, by Lyle V. Jones and Thomas E. Jeffrey. Rept. on Contract DA 19-129-QM-1291. Nov 59, 110p. 4 refs. Technical rept. R-5; FEA MRS-5902.
Order from LC mi$5.70, ph$16.80 PB 145 112

The purpose of this investigation was to determine: (1) The minimum number of characteristics necessary for the full investigation of the items studied; (2) The relative importance of these characteristics in the determination of overall acceptability by the soldier user. This research has undertaken to define 6 or 7 dimensions that provide most of the information normally found in 18 dimensions. A further result has been to show that by proper selection, only 4 dimensions may be necessary for the prediction of troop acceptability. (Author)

PHYSICS

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TECHNICAL PAPERS FROM THE QUARTERLY REVIEW OF BUMBLEBEE ACTIVITIES, JANUARY-DECEMBER 1958. Rept. on Contract NOrd-7386. [1958] 67p. 30 refs. Bumblebee rept. no. 283; AD-226 974.
Order from LC mi$3.90, ph$10.80 PB 145 307

Contents:
Mechanism of propane-air reaction based on analysis of flame front profiles
Skin friction measurements during ascending Viking flight
Ceramic rod antennas
Analysis of a transistor operational amplifier
Design and performance criteria of the acceleration switching hydraulic servo
Structure of hydrocarbon (C_2)-oxygen flames
Molecular diffusion studies in gases at high temperatures
Frequency analysis of a control loop containing a bistable element
A transistorized voltage-controlled FM subcarrier oscillator
Evaluation study of a transistor operational amplifier
Accuracy of zero-counters and their use in high-precision doppler measuring devices
A compiler for network analysis

Duke U., Durham, N. C.
MIXED BOUNDARY VALUE PROBLEMS IN MATHEMATICAL PHYSICS, by I. N. Sneddon and F. J. Lockett. Rept. on Contract AF 18(600)1341. 4 Jan 60, 178p. 70 refs. AFOSR-TN-60-51.
Order from LC mi$8.10, ph$27.30 PB 145 476

The occurrence of mixed boundary value problems in mathematical physics; The problem of the electrified disk; Dual integral equations and dual series; and Electrostatic problems.

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
THEORETICAL AND EXPERIMENTAL RESEARCH IN THERMOELECTRICITY. Scientific rept. no. 1 on Contract AF 19(604)4153, continuation of AF 33(616)3984, and on Contract Nonr-1841(51). 31 Dec 59, 163p. 31 refs. AFCRC-TN-60-125.
Order from OTS $3.00 PB 161 468

Techniques and equipment for growing single crystals of Bi_2Te_3. Preparation of HgTe-CdTe alloys with a general discussion of measurements on this material.

Measuring equipment which has been developed to measure those parameters which characterize thermoelectric material. Investigation of both the dependence of thermoelectric parameters on detailed microscopic processes and the actual behavior of thermoelectric devices. Theoretical analyses of devices and materials.

Maryland U., College Park.
PROPERTIES OF THE SUPERCONDUCTING CURRENT WHICH FOLLOW FROM CAUSALITY, by Richard A. Ferrell. Rept. on Contract Nonr-1797(00). Jan 59, 19p. 23 refs. Physics Dept. Technical rept. no. 129.
Order from LC mi$2.40, ph$3.30 PB 145 443

Acoustics

Harris Transducer Corp., Woodbury, Conn.
THE THEORY OF ACOUSTIC REFLECTORS FOR SONAR APPLICATIONS. REPORT 2. THE VARIABLE POSITION RESONATOR, by H. K. Farr and R. L. Townsend. Rept. on Contract Nonr-2720(00). 13 Feb 59, 20p. HTC-73-R2.
Order from LC mi$2.40, ph$3.30 PB 145 248

This report is the second in a program for the study of passive devices for the reflection or scattering of sound energy in deep water. The object of the general program is to develop alternatives to the conventional low density baffle materials (cork, "cell-tite", etc.) which fail at high hydrostatic pressures. Report I of this project discussed one device, an end loaded hollow cylinder, which was studied as a possible reflector of this kind. The present report is a study of another device, the passive variable position (V. P.) resonator. This consists of a sealed external shell surrounding an internal mass and coupled to this mass by a spring which permits relative motion between the two.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
CHARACTERIZATION OF PROBABILITY DISTRIBUTIONS FOR EXCESS PHYSICAL NOISES, by Jack Hilibrand. Rept. on Contract DA 36-039-sc-64637. 7 Sep 56, 54p. 30 refs. Technical rept. 276; AD-149 545.
Order from LC mi$3.60, ph$9.30 PB 145 526

Theoretical and experimental techniques are described for characterizing the probability distributions of certain excess physical noises by their moments. Theoretical methods are presented for applying this "moments technique" in the time domain to random-pulse noise, and in the frequency domain to any random functions for which the moments exist. The frequency-domain technique is used for a theoretical study of the approach to a gaussian distribution of random-pulse noise that is subjected to severe band-limiting. In contrast, the departure from a gaussian distribution of random-pulse noise that is band-limited by RC cutoffs at low and high frequencies is examined by using the time-domain technique. It is found that the approach of noise distributions to gaussian is governed by the "memory" of the filter system rather than simply by its bandwidth. (Author)

Electricity and Magnetism

Antenna Lab., Calif. Inst. of Tech., Pasadena.
CURRENT ON AN INFINITELY LONG CYLINDRICAL ANTENNA, by Hans H. Kuehl. Technical rept. no. 23 on Contract AF 18(600)1113. Oct 59, 11p. 3 refs. AFOSR-TN-59-1168.
Order from LC mi$2.40, ph$3.30 PB 145 316

The infinitely long circular cylindrical antenna driven at some cross section by a localized electromotive force, V, circumscribing the cylinder in a peripheral band is considered. The asymptotic expression for the current at large distances from the driving e. m. f. is derived using the saddle point method. It is shown that the amplitude of this current is proportional to the reciprocal of the logarithm of axial distance from the driving e. m. f. (Author)

Antenna Lab., Calif. Inst. of Tech., Pasadena.
A NOTE ON CURRENTS ON A QUADRATIC SURFACE, by George G. Weill. Technical rept. no. 21 on Contract AF 18(600)1113. Sep 59, 9p. 2 refs. AFOSR-TN-59-1102.
Order from LC mi$1.80, ph$1.80 PB 145 319

Although no explicit general solution is known for the vector integral equation satisfied by the current density vector on a conducting surface, it is shown in the following report that the vector equation can be "scalarized" in the case of a quadratic conducting surface. (Author)

Electro-Mechanics Co., Austin, Tex.
VARIABLE-mu MAGNETOMETER. Final rept. on Contract AF 19(604)1742. 5 Jan 59, 28p. AFCRC-TR-59-208; AD-210 483.
Order from LC mi$2.70, ph$4.80 PB 145 570

This project includes the investigation of the feasibility of a variable-μ magnetic variometer and the construction of workable instruments that might be used to measure and record the fluctuations of magnetic fields. The basic principle involved is to utilize the variation in the permeability of a core that occurs when the core is placed in a fluctuating magnetic field such as the earth's field. The effect of this variation in the permeability is a change in the inductance of a coil that is wound on the magnetic core. The core and coil form a variable inductance, the values of which determine the frequency of the oscillating circuit of which the inductance is a part. A frequency counter may be used to read the frequency of the oscillating circuit. Consequently, the

variations in a magnetic field may be registered with a frequency counter; or the variations in frequency, as indicated by the counter, may be shown graphically with the addition of a pen recorder.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
MAGNETIC PROPERTIES OF SOME FERRITE MICROPOWDERS, by A. E. Berkowitz and W. J. Schuele. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)5041. Nov 59, 15p. 2 refs. WADC Technical rept. 59-709.
Order from OTS $0.50 PB 161 533

Micropowders of stoichiometric copper, nickel, and cobalt ferrites were prepared by low temperature (<800°C) treatment of the coprecipitated metal oxalates. The magnetic properties of each ferrite were determined as functions of particle or crystallite size in the range from 70 to >2000 A. Particle sizes were determined from x-ray line broadening and from electron micrographs. The micropowders exhibited superparamagnetic, single domain, or multi-domain behavior depending on the particle size. The critical size for single domain behavior, depending on composition, was between 300 and 700 A. In this size range, high coercive force and remanence were observed in spite of appreciable sintering of the particles in some cases. The remanence values and the magnitude and temperature dependence of the coercive force indicated that magnetocrystalline anisotropy determined the properties of the single domain particles. The magnetic properties of the very small particle size samples showed the large temperature dependence characteristic of superparamagnetism. (Author)

Miami U., Coral Gables, Fla.
ON THE HIGH-TEMPERATURE EXPANSIONS OF THE SUSCEPTIBILITY OF A HEISENBERG FERROMAGNET, by Harry Brown. Rept. on Contract AF 49(638)630. 1 Oct 59, 19p. 9 refs. AFOSR-TR-59-154, AD-231 828.
Order from LC mi$2.40, ph$3.30 PB 145 663

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
MODAL ANALYSIS AND SYNTHESIS OF ELECTROMAGNETIC FIELDS. CHAPTER IV. ASYMPTOTIC EVALUATION OF INTEGRALS, by L. B. Felsen and N. Marcuvitz. Rept. on Contract AF 19(604)2031. 21 Oct 59, 80p. 13 refs. Rept. R-776-59; PIB-705; AFCRC-TN-59-991.
Order from LC mi$4.50, ph$12.30 PB 145 768
Contents:
General considerations
Saddle points and the paths of constant level and constant phase
Asymptotic expansions of certain classes of integrals
Examples
Appendix A: Asymptotic expansion of
$$I(\Omega) = \int_{\Gamma} G(s)\, e^{\Omega \tau(s)}\, ds$$
Appendix B: Higher order derivatives of $G(s) = f(z)\frac{dz}{ds}$
Appendix C: Asymptotic expansion of the Airy Functions

Northwestern U., Evanston, Ill.
OPTICAL ABSORPTION, PHOTOCONDUCTIVITY, ELECTRICAL CONDUCTIVITY, AND HALL EFFECT IN GERMANIUM MONOSULFIDE, by Carl R. Betz. Doctoral thesis. Rept. on Contract NObsr-72520. Apr 58, 97p. 33 refs. AD-211 260.
Order from LC mi$5.40, ph$16.80 PB 145 818

GeS crystals grown from the vapor phase are optically measured. The geometry of these crystals is ideally suited for optical measurements. Measurement of the optical absorption spectrum was made over a wide range of temperature and to very large values of the absorption constant. Measurements of photoconductivity are also reported for several temperatures. For conductivity measurements at high temperatures, samples were sealed into a bulb constructed of 35-mm Pyrex tubing. Electrical connections entered through a 4-wire tungsten press. A chromel-alumel thermocouple was also sealed into the bulb, which was then sealed on to a vacuum system. At low temperatures, the electrical conductivity changed very little from the room temperature value. The electrical conductivity ranges from 0.14 to 0.04 $ohm^{-1}\ cm^{-1}$. The problems that were encountered with crystal contacts, and with electrical measurements in general, made the possibility of a satisfactory Hall measurement seem unlikely for some time. Thickness of the crystals was measured by transmission interference fringes in the region of high transmission, whenever a sufficient number of sharp maxima could be obtained to establish the thickness with reasonable accuracy. A derivation of the expressions for the absorption constant in the cases of direct and indirect transitions is included in Appendix A. Some measurements of the decay of the photo-current with time are reported in Appendix B.

Syracuse U. Research Inst., N. Y.
FERROMAGNETIC RESONANCE IN MAGNETITE BELOW TRANSITION TEMPERATURE, by Gerog Herz, R. A. Johnson and D. W. Healy, Jr. Final rept. on Contract AF 49(638)77. June 58, 41p. 14 refs. SURI rept. no. EE472-587F; AFOSR-TR-58-118; AD-201 883.
Order from LC mi$3.30, ph$7.80 PB 137 552

The conditions for electronic resonance in an orthorhombic magnetic crystal are examined and the relationship between $\frac{\omega}{\gamma}$ and H required for resonance is predicted. The effect of pressure and a biasing magnetic field on the selection of the easy axis of magnetization are also examined as well as the role which magnetic dipolar forces may play in the observed anisotropy.

Technische Hochschule, Aachen (Germany).
MEASUREMENTS OF THE DIFFUSION OF ELECTRONS OUT OF STRONG SHOCK WAVES, by H. Groenig. Final rept. on Contract AF 61(514)1046. June 59, 50p. 24 refs. AFOSR-TR-59-160.
Order from LC mi$3.30, ph$7.80 PB 145 680

The diffusion processes which occur with the transition of strong shock waves in gases have been investigated by means of a gas discharge probe developed for these purposes. The experiments have been performed in argon of different degrees of impurities.

No difference with the various degrees of impurities can be observed. The Mach numbers have been restricted to the range of 5 to 10, where the experiments are most interesting due to the relatively small degree of ionization.

Union Thermoelectric Corp., Forest Park, Ill.
HIGH FREQUENCY FIFTH HARMONIC UNITS, by G. S. Mero, R. D. Cortright and others. Final rept. for 25 June 52-24 Dec 55 on Development and Operation of an Experimental Manufacturing Facility for Quartz Crystal Units, Contract DA 49-025-sc-118. [1955] 327p. AD-100 223.
Order from LC mi$11.10, ph$50.10 PB 137 789

Development of mass production techniques together with drawings, specification, etc. for the manufacture of "CR-54/U" quartz crystal units on 60.75 mc, 75.45 mc, 83.542 mc, 90 mc, and 100 mc. Investigation of Lapmaster and Grinder as mass production tools. Development and design of an experimental, semi-automatic evacuating and induction sealing machine. Engineering design for a semi-automatic sputtering machine. Design of a semi-automatic X-ray blank-sorting machine.

Electronics

Antenna Lab., Calif. Inst. of Tech., Pasadena.
RADIATION PATTERNS OF THE NOISE EMISSION FROM A GASEOUS DISCHARGE, by Nick George. Technical rept. no. 22 on Contract AF 18(600)1113. Oct 59, 31p. 15 refs. AFOSR-TN-59-1101; AD-229 974
Order from LC mi$3.00, ph$6.30 PB 145 320

Theoretical and experimental radiation patterns are given in spectral form for the thermal radiation from a cylindrical discharge column which is adjacent to a long thin slot in a metallic plane. A spatial distribution is predicted which exhibits interference minima and maxima when the length of the slot and the wavelength of the emission are the same order of magnitude. The analysis is based on Maxwell's equations and the Leontovich-Rytov distributed-source generalization of Nyquist's noise formula. Fraunhofer pattern measurements are presented in which an argon source is used to excite slots of 7.3π and 9.5π radians in length. Data are also presented to show the effects of variations in the pressure and the d-c current of the discharge.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
TWO THEOREMS IN MULTI-WEIGHTED SUMS, AND THEIR APPLICATION IN THE STABILITY ANALYSIS OF ACTIVE LINEAR SYSTEMS, by Basil R. Myers. Technical note no. 10 on Contract AF 49(638)63. 5 Nov 59, 21p. 6 refs. AFOSR-TN-59-1096; AD-231 383.
Order from LC mi$2.70, ph$4.80 PB 145 558

The first theorem in this paper shows that the collection of all normalized, nonnegatively multiweighted sums of a finite set of vectors belonging to an arbitrary finite-dimensional vector space is contained in the convex hull of the vertex vectors of the normalized weights. The second theorem states a sufficient condition under which the collection is complete, i.e. such that there is no point in the convex hull which is not a point of the sum. Two corollaries of this theorem identify particular types of sum for which the collection is complete. Application of the theorems in the stability analysis of active linear systems with multi-parameter variance leads to a useful graphical method which might be described as a generalization of Nyquist's criterion for stability. (Author)

Electronics Research Lab., U. of California, Berkeley.
DETERMINATION OF SOURCE OF RADIATION OF CIRCULAR WAVEGUIDE AND REFLECTING DISK, by Thomas W. Doeppner. Rept. on Contract N7onr-29529. 21 Apr 59, 33p. 5 refs. Rept. no. 86; IER Series no. 60, Issue no. 235.
Order from LC mi$3.00, ph$6.30 PB 145 694

A study was made of the radiation from the open end of a circular waveguide, in front of which a circular reflecting disk was placed. This system was found to have an apparent circular ring source, the ring being parallel to the disk, concentric with the waveguide, and at greater distance from the waveguide aperture than the disk.

Institute of Mathematical Sciences, New York U., N. Y.
MAXIMAL GAINS OF ANTENNAS, by Nathan Newman and Wilhelm Magnus. Rept. on Contract AF 19(604)5238. Sep 59, 48p. 2 refs. Research rept no. EM-142; AFCRC-TN-59-779.
Order from LC mi$3.30, ph$7.80 PB 145 291

The gain of an antenna is defined as the ratio of the radiated energy $\mathcal{E}$ to the heat loss $\mathcal{W}$. For a linear, finite antenna of length 2ℓ, this gain can be shown to have a least upper bound B for all possible current distributions and for all ℓ. We determine B explicitly. For a fixed small value of ℓ, the maximal gain is computed up to an error term of order ℓ^3. If the gain of an antenna is defined as the ratio of the energy $\mathcal{E}^*$ radiated into a half-space, to the total heat loss $\mathcal{W}$, similar but less complete results can be derived. Finally, it is shown that the problem of maximizing $\mathcal{E}^*/\mathcal{E}$ does not have a solution. There exists no realizable current distribution on the antenna which maximizes this quotient. (Author)

Microwave Lab., Stanford U., Calif.
NONLINEAR EFFECTS IN ELECTRON PLASMAS, by P. A. Sturrock. Scientific rept. no. 4 on Contract AF 19(604)5226. Oct 59, 18p. 12 refs. M. L. rept. no. 654; AFCRC-TN-59-956.
Order from LC mi$2.40, ph$3.30 PB 145 688

The effect of nonlinear terms in the dynamical equations governing wave propagation in plasmas may be analyzed by a perturbation procedure which is acceptable for amplitudes which are not too large. Two

theorems concerning wave interaction are proved. The first relates energy-transfer between a group of interacting waves to the frequency of these waves. These "action-transfer relations" lead to the Manley-Rowe relations for steady-state or quasi-steady-state configurations. The second theorem relates the frequency-displacements of a group of interacting waves to the energies of these waves. The properties of electron plasmas undergoing longitudinal oscillations are re-examined in the light of the preceding theorems. The interaction between longitudinal (electrostatic) and transverse (electromagnetic) waves in plasmas is considered.

Minnesota U., Minneapolis.
STUDY OF ELECTRICAL AND PHYSICAL CHARACTERISTICS OF SECONDARY EMITTING SURFACES, by W. G. Shepherd. Rept. on Research on Particle Physics of Electronic Components, Contract AF 33(616)3325. Dec 59, 65p. 18 refs. WADC Technical rept. 59-473.
Order from OTS $1.75 PB 161 491

A study of the oxidation schedule for silver-magnesium alloy is described, and a revised schedule is presented for the preparation of MgO films with optimum secondary yield. A broad investigation of the influence of adsorbed cesium on the secondary emission properties of MgO films is reviewed. (See also PB 140 869)

National Research Labs., Ottawa (Canada).
DIRECT MEASUREMENT OF POWER SPECTRA BY AN ANALOG COMPUTER, by T. H. Wonnacott. Sep 59, 46p. 5 refs. Mechanical engineering rept. MK-5; AD-230 392.
Order from LC mi$3.30, ph$7.80 PB 145 536

The power spectral density (spectrum) of a continuous random process is estimated in the most natural way: the record is passed through a filter selecting frequencies close to f_o, then squared, and the resulting "power" is averaged to give an estimate of the spectrum at f_o. The random nature of the record implies that this spectrum estimator is also a random variable, and its variation is investigated. The analysis often parallels that of the digital analysis of a discrete time series. As an example the spectrum of band-limited white Gaussian noise is measured. (Author)

Oxford U. (Gt. Brit.)
THE RADIATION RESISTANCE OF AN ELEMENTARY DIPOLE IN ANISOTROPIC PLASMAS, by Herwig Kogelnik. Technical note no. 3 on Contract AF 61(514)1183. [1960] 14p. 13 refs. AFOSR-TN-60-49.
Order from LC mi$2.40, ph$3.30 PB 145 669

A theoretical study is made of the radiation resistance of and the power radiated by an elementary dipole and "short" antennas placed in anisotropic dielectric media such as an ionized gas in a magnetic field.

Philips Labs., Irvington-on-Hudson, N. Y.
RESEARCH ON NOISE IN HIGH POWERED KLYSTRONS, by William R. Atkinson. Final rept. on Contract AF 18(603)33, Supp. 1 (57-345). 31 May 58, 42p. 19 refs. Technical rept. no. 129; AFOSR-TR-58-90; AD-162 122.
Order from LC mi$3.30, ph$7.80 PB 137 551

Several techniques were used to measure the spectral dependence of the mean square frequency deviations of two-cavity klystron oscillators having an integrated rms frequency deviation of a few hundred cycles per second over the entire audio frequency range. Comparison of the measurements with existing theories of electronic noise indicated that mechanisms that were not purely electronic in nature were present in all the klystrons tested. (See also PB 128 816)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
ELECTRON-STIMULATED ION OSCILLATIONS, by Paul Chorney. Rept. on Contract DA 36-039-sc-64637. 26 May 58, 84p. 11 refs. Technical rept. 277; AD-200 516.
Order from LC mi$4.80, ph$13.80 PB 145 266

Certain ion oscillations that are sometimes excited in microwave tubes were investigated on a theoretical basis. A study of some general properties of propagation in plasma-loaded waveguides was made; the plasma consisted of both stationary ions and an electron beam. The effect of an axial magnetic field was included in the analysis. Specifically, the propagation in waveguides that were loaded merely with a stationary ion plasma was studied. It was found that these waveguides are propagating structures at frequencies that are very low, as compared with the empty waveguide cutoff frequency. A short-circuited section of an ion-loaded waveguide, which was considered as a resonant cavity, was found to have resonant frequencies of the order of the ion plasma frequency and ion cyclotron frequency (a few megacycles per second for positive gas ions such as hydrogen). The energy transfer from a beam traversing an oscillating ion-loaded cavity to the fields of the cavity was calculated, and a criterion for oscillation was established. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
IMPEDANCE AND POWER TRANSFORMATION BY THE ISOMETRIC CIRCLE METHOD AND NON-EUCLIDEAN HYPERBOLIC GEOMETRY, by E. Folke Bolinder. Rept. on Contract DA 36-039-sc-64637. 14 June 57, 100p. 110 refs. Technical rept. 312; AD-208 704.
Order from LC mi$5.40, ph$15.30 PB 145 778

The means of solving microwave problems by modern geometry is investigated. The isometric circle method, an elementary inversion method for the linear fractional transformation, and models of non-Euclidean hyperbolic geometry are used. The isometric circle method is applied to numerous examples of impedance and reflection-coefficient transformations

through bilateral 2-port networks. The method is transferred to, and generalized in, the Cayley-Klein model of 2-dimensional hyperbolic space for impedance transformations through lossless 2-port networks. A similar transfer and generalization is performed in the Cayley-Klein model of 3-dimensional hyperbolic space for impedance transformations through lossy 2-port networks.

Stanford Research Inst., Menlo Park, Calif.
RAY-TRACING AND DIFFRACTION IN A MEDIUM WITH VARIABLE PERMITTIVITY AND ATTENUATION, by James A. Cochran. Rept. on Contract AF 19(604)3458. Oct 58, 54p. 65 refs. Technical rept. 65; AFCRC-TN-58-555; AD-160 864.
Order from LC mi$3.60, ph$9.30 PB 137 791

An asymptotic development of the electromagnetic field in a region with dielectric constant of the form $(1 + Kr^{-1})$, when there is a source at an infinitely remote point, has been obtained previous to this report. In the investigation reported here, field expressions have been obtained for propagation in this medium, neglecting diffraction effects. A comparison between field values for the two methods has been made for a given numerical example that permits an assessment of the importance of diffraction in such problems. Parameters for the medium of the numerical example were selected to stimulate an ionized gas cloud. Brief attention is also given to the effect of deviation from unity of the effective dielectric constant in lossy obstacles, in an attempt to evaluate the accuracy of present experimental techniques of model measurement. (Author)

Tennessee U. Engineering Experiment Station, Knoxville.
PARASITIC EXCITATION OF CIRCULAR ARRAYS, by T. L. Simpson, H. P. Neff, and J. D. Tillman. Scientific rept. no. 2 on Contract AF 19(604)4967. 1 Aug 59, 65p. 6 refs. AFCRC-TN-59-553; AD-220 382.
Order from LC mi$3.90, ph$10.80 PB 145 294

An analysis is given of circular antenna arrays in which only one element of the array is driven. The configuration which is considered consists of m identical parallel dipoles or monopoles which are spaced uniformly around the circumference of a circle. An additional element, not necessarily having the same half length, is located at the center. There are two ways to excite the antenna by driving only one element. If an element in the ring is driven, a pattern with directivity in the plane of the ring results. The other method of exciting the array parasitically is to drive the center element. Experimental confirmation is given for the theoretical analyses in both parts. The agreement is quite good. Both antennas appear to be entirely practical. The patterns for the case where a ring element is driven are comparable to those of a Yagi antenna. At frequencies where the array is rather large physically, the beam can be steered by a simple switching system which selects the driven element. The principal use of the omnidirectional system seems to be as a broadcast antenna, utilizing its vertical directivity to reduce fading. (Author)

Tufts U., Medford, Mass.
STUDIES OF A HIGH CURRENT ELECTRICAL DISCHARGE IN AN IONIZED GAS, by Lewis S. Combes and Samuel P. Zimmerman. Scientific rept. no. 1 on Contract AF 19(604)1578. 16 June 58, 61p. 10 refs. AFCRC-TN-58-439; AD-152 614.
Order from LC mi$3.90, ph$10.80 PB 145 690

In Section 1 are described experiments with a pinched discharge in a toroidal glass tube stabilized by an included magnetic field. Photographs taken through an image converter show how the discharge pinches and then becomes unstable. In Section 2 experiments using a straight discharge tube are described. Photographs are shown of discharges in this tube that remained stable for approximately 15 to 20 microseconds.

Molecular Physics and Spectroscopy

Institute of Geophysics, U. of California, Los Angeles.
EMISSION SPECTRA OF THE OXYGEN MOLECULE IN LABORATORY AFTERGLOWS AND THE NIGHT AIRGLOW, by Charles A. Barth. Scientific rept. no. 1 on Contract AF 19(604)2143. Mar 58, 90p. 49 refs. AFCRC-TN-59-482; AD-230 695.
Order from LC mi$4.80, ph$13.80 PB 145 653

This report will first briefly review the spectroscopy of the oxygen molecule. Then, the experimental findings on the emission spectra of laboratory afterglows will be enumerated and analyzed. The chemistry of the upper atmosphere, or chemical aeronomy, will be described and then related to the molecular oxygen emission spectra of the night airglow. Finally, the laboratory and upper atmosphere findings will be used to estimate the lifetimes of the metastable oxygen molecules. The high-speed spectrograph and the afterglow flow systems will be described in the Appendix.

Johns Hopkins U., Baltimore, Md.
FAR INFRARED SPECTRA OF SOME SYMMETRIC TOP MOLECULES, by Dean W. Robinson and Donald A. McQuarrie. Rept. on Contract AF 49(638)468 [1958] 17p. 8 refs. [AFOSR] TN-59-967.
Order from LC mi$2.40, ph$3.30 PB 145 308

Pure rotational spectra out to 30 cm^{-1} are presented of the gaseous molecules CH_3CN, CH_3CCH, HCF_3 and $(CH_3)_3N$. These spectra are interpreted in the view of the rotational constants previously determined from microwave data. The heretofore undetermined value of D_J for CH_3CN has been estimated to be 1.45×10^{-7} cm^{-1}, the value of D_{JK} for $(CH_3)_3N$ is shown to be positive, and intensity distribution in the high -J subbands of the oblate top, HCF_3, has been estimated to have its center at K = 17. (Author)

Lyman Lab. of Physics, Harvard U., Cambridge, Mass.
PHOTOELECTRIC AND INTERNAL CONVERSION SPECTRA OF NEUTRON-DEFICIENT IRIDIUM ISOTOPES, by Walter Reilly Kane. Doctoral thesis. Rept. on Contract Nonr-1866(19). 23 Jan 59, 139p. 116 refs. Technical rept. no. 3-9.
Order from LC mi$6.90, ph$21.30 PB 145 385

Photoelectric and internal conversion spectra of the neutron-deficient isotopes Ir^{188}, Ir^{189}, and Ir^{190} have been investigated with the aid of a double-focusing spectrometer. The energies and intensities of a large number of electromagnetic transitions are reported.

Institute of Geophysics, U. of California, Los Angeles.
BLUE NITRIC OXIDE AFTERGLOW, by Charles A. Barth, William J. Schade, and J. Kaplan. Scientific rept. no. 2 on Contract AF 19(604)2143. Sep 58, 8p. 7 refs. AFCRC-TN-59-291; AD-230 683.
Order from LC mi$1.80, ph$1.80 PB 145 672

A change in the intensity distribution of the emission spectra of the blue nitric oxide afterglow has been observed with a rare gas added to the afterglow mixture. The sensitivity of the vibrational intensity distribution of the nitric oxide afterglow emission spectra to the addition of helium is evidence that the afterglow emission spectra arises from the three-body recombination of a ground state oxygen atom and a ground state nitrogen atom by way of some intermediate state into the excited upper states of the beta, gamma, and infrared bands.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
CALCULATION OF ENERGY LEVELS FOR INTERNAL TORSION AND OVER-ALL ROTATION, III, by Dudley R. Herschbach. Rept. on Contract N5ori-1866(14). [1959] 52p. 52 refs.
Order from LC mi$3.60, ph$9.30 PB 145 383

A general treatment of hindered internal rotation is given for molecules that can be regarded as a rigid symmetric top attached to a rigid frame which may be completely asymmetric. The perturbation approach developed in previous papers is simplified and extended by use of a method which relates the perturbation coefficients to the exact energy levels obtainable for the limiting case of two coaxial symmetric tops. Tables are given which provide the torsional energy levels and the perturbation coefficients through fourth order in the coupling between internal and over-all rotation.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
STARK EFFECT ON THE HYPERFINE STRUCTURE OF CESIUM^{133}, by R. D. Haun, Jr. Doctor's thesis. Rept. on Contract DA 36-039-sc-64637. 18 Jan 57, 67p. 37 refs. Technical rept. 322.
Order from LC mi$3.90, ph$10.80 PB 145 130

The change of the hyperfine-structure separation energy caused by an electric field has been measured in cesium^{133} by the atomic-beam magnetic-resonance method. The shift of the $(F=4, m_F=0) \leftrightarrow (F=3, m_F=0)$ transition frequency (9192.6 mc/sec) caused by electric field ξ is given by $\Delta(\xi) = -2.29 \times 10^{-6} (1 \pm .03)\xi^2$ cps, where ξ is in volt/centimeter. This number is 2.8 times the value predicted from the atomic polarizability measurements of H. Scheffers and J. Stark, if a simplified theory that neglects hyperfine-structure perturbations of the ground-state wave functions is used. A more precise theory which takes into account these wave-function differences has been outlined but the calculations have not been carried out in detail. (Author)

Stanford Research Inst., Menlo Park, Calif.
SURVEY OF ELECTRON TRANSFER SPECTRA OF INORGANIC IONS, by Rudolph J. Marcus. Technical note no. 2 (Rept. no. 13) on Contract AF 18(603)7. 1 Dec 59, 17p. 32 refs. AFOSR-TN-59-1322.
Order from LC mi$2.40, ph$3.30 PB 145 670

The literature was searched for electron transfer spectra of inorganic ions. These are reported, together with the chemical evidence of light-induced electron transfer and with thermodynamic data needed for interpretation of the spectra. (Author)

University of Southern California. Engineering Center, Los Angeles.
DIFFUSION OF A FULLY IONIZED GAS CONFINED IN A STRONG MAGNETIC FIELD, by Toyoki Koga. Technical note on Contract AF 18(603)95. 30 Dec 59, 36p. 14 refs. USCEC rept. 56-209; AFOSR-TN-59-1162.
Order from LC mi$3.00, ph$6.30 PB 145 638

The purpose of the present report is to develop a method of approach which may be valid for a case where the distribution of particles deviates considerably from the Maxwell distribution.

Uppsala U. (Sweden).
DERIVATION OF THE CLEBSCH-GORDAN-COEFFICIENTS BY MEANS OF PROJECTION OPERATORS, by Jean-Louis Calais. Technical note no. 25 on Contract AF 61(514)1200. 1 June 59, 22p. 10 refs. AD-227 247.
Order from LC mi$2.70, ph$4.80 PB 145 189

The Clebsch-Gordan coefficients for the coupling of 2 angular momenta are derived by using the projection operator technique, developed by Lowdin. The derivation is done in 2 steps: (1) for the so-called principal case, i.e. R=M; and (2) for the general case with an arbitrary M. Two different derivations are given for the principal case, a direct one, and one based on a recursion procedure. The general case is obtained from the principal case with a step-down operator. (Author)

Uppsala U. (Sweden).
THE IDEA OF ATOMIC ASSOCIATIONS IN A SIMPLE FORM OF PERTURBATION METHODS, by Heinzwerner Preuss. Technical note no. 24 on Contract AF 61(514)1200. 20 Apr 59, 21p. 5 refs.
AD-226 405.
Order from LC mi$2.70, ph$4.80 PB 145 188

Quantum chemistry must become more general in order to obtain closer connections with chemical questions and chemical laws. This brief paper is a starting-point for further treatments in this sense and also an outline of a new basis for quantum chemical calculations. The opinion presented here is that agreement of molecular calculations with experiment can be expected only when we start from a solved many-electron one-center-problem or from formulas which include the general atomic problem as a basis.

Uppsala U. (Sweden).
ON THE NON-ORTHOGONALITY PROBLEM ON THE SEMI-EMPIRICAL MO-LCAO METHOD, by Giuseppe del Re. Technical note no. 20 on Contract AF 61(514)1200. 20 Oct 58, 20p. 13 refs.
AD-226 404.
Order from LC mi$2.40, ph$3.30 PB 145 187

A treatment of the non-orthogonality problem is given for the case when overlap integrals are assumed to be proportional to the corresponding bond-integrals. Formulas for reducing explicitly, albeit formally, the non-orthogonal case to an orthogonal one are derived and discussed. Formulas for dipole-moments and first-order perturbation coefficients are also given, and their implications stated. (Author)

Uppsala U. (Sweden).
SYMMETRY RELATIONS AND ELECTRIC MULTIPOLE INTERACTIONS, by Laurens Jansen. Technical note no. 22 on Contract AF 61(514)1200. 15 Jan 59, 25p. 18 refs.
Order from LC mi$2.70, ph$4.80 PB 145 325

It is shown how expressions for the electrostatic interaction between molecular charge distributions in multipole form may be considerably simplified by making use of symmetry relations. These relations refer both to invariance properties of the electrostatic potential, and to the internal symmetry of the distributions themselves. An equivalence theorem is derived between three- dimensional distributions of charge and linear assemblies along an axis of symmetry of the molecule. On the basis of this theorem a unique definition can be given for the scalar molecular multipole moments. For molecules with symmetry C_{sv} or D_{sh} the theorem holds for interactions between multipoles of order $n \lessdot s$. Therefore, if the molecule has cylindrical symmetry (point groups $C_{\infty v}$ or $D_{\infty h}$), the theorem is valid for multipole moments of arbitrary order. (Author)

Washington U., Seattle.
STUDIES IN MOLECULAR SPECTROSCOPY, by P. C. Cross, D. F. Eggers, Jr., and W. T. Simpson. Technical rept. for 15 July 55-30 Sep 59 on Contract AF 18(600)1522. [1960] 12p. AFOSR-TR-60-3.
Order from LC mi$2.40, ph$3.30 PB 145 679

The cyclopropene molecule, C_3H_4, is the only example of a three-membered ring containing a double bond, and it was studied intensively along with a random deuterium derivative. The infrared spectrum of hydrogen sulfide shows some bands with a very odd and unsymmetrical shape; they absorb strongly at frequencies higher than the band center, but very weakly lower than the center. This is explained quantitatively.

Optics

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A LIGHT-SCATTERING METER FOR THE DETERMINATION OF THE SIZE DISTRIBUTION OF THE AEROSOL, by Robert W. Fenn. 1 June 59, 19p. 7 refs, USASRDL Technical rept. 2038.
Order from LC mi$2.40, ph$3.30 PB 145 659

A new light-scattering meter is described. The instrument allows the measurement of the intensity of light scattered from aerosol particles over an angular range from 2.5 to 135 degrees with respect to the direction of the incident light beam. The measurements can be made with four different wavelengths. The instrument incorporates the ability to investigate polarizing effects connected with light scattering. Some results of test measurements made in natural aerosol and latex particles are presented.

Centro di Studio per la Fisica Delle Microonde (Italy).
EXPERIMENTAL TEST OF A 360° FIELD LENS FOR MICROWAVES, by A. M. Scheggi and G. Toraldo di Francia. Technical note no. 6 on Contract AF 61(052)67. Sep 59, 14p. 12 refs. AFCRC-TN-59-992.
Order from LC mi$2.40, ph$3.30 PB 145 282

The present report is concerned with the construction and experimental test of a perfect configuration lens, of the type described by G. Toraldo di Francia as well as of a stack of such lenses. Suitable feeders were designed and constructed. Radiation patterns and wave front plots are given from which there results a very good agreement with the theory. (Author)

Cornell U., Ithaca, N. Y.
THE EFFECT OF REFLECTIVITY ON THE MEASUREMENT OF ATTENUATION COEFFICIENTS IN THE 100 ev RANGE, by D. H. Tomboulian. Technical rept. on Contract Nonr-401(37). Mar 59, 16p. 6 refs. AD-212 582.
Order from LC mi$2.40, ph$3.30 PB 145 798

Special problems are treated that are encountered when attempts are made to measure the attenuation coefficient of matter irradiated by very low energy (40 - 120 ev) photons. The process consists in comparing I(x), the intensity transmitted by an absorber of thickness x, with the intensity I_0 incident upon it. Quantitatively the attenuation is expressed by the relation $I(x) = I_0 \exp(-\mu x)$ where μ represents the total attenuation coefficient; i. e., the probability (per unit thickness of matter traversed) that a photon will be removed from the incident beam by all processes which play a significant role in the limited range of photon energies and for the particular physical characteristics of the absorber. (Author)

Institute of Optics, U. of Rochester, N. Y.
OPTICAL CONSTANTS OF GERMANIUM IN THE REGION, 0-10 ev, by M. P. Rimmer and D. L. Dexter. Rept. no. 3 on Contract AF 49(638)432. Oct 59, 13p. 5 refs. AFOSR-TN-59-1254.
Order from LC mi$2. 40, ph$3. 30 PB 145 646

A program has been written for the IBM 650 Digital Computer to evaluate the Kramers-Kronig dispersion relation between real and imaginary parts of the index of refraction, n and k. By this means measurement of the reflection coefficient over a sizable energy range allows the determination of n and k throughout most of this region. Reflection data of Philipp and Taft on germanium have been analyzed in this way, and the results are compared with those of Philipp and Taft obtained by another method. The results are similar, minor differences occurring in the fine structure. (Author)

Johannes Gutenberg U. (West Germany).
THEORETICAL INVESTIGATION OF THE VISIBILITY UNDER SPECIAL ATMOSPHERIC CONDITIONS (THE HORIZONTAL VISUAL RANGE OF NOT SELF-LUMINOUS OBJECTS UNDER OVERCAST SKY) by Fritz Kasten and Fritz Möller. Final rept. for 1 July 58-30 Sep 59 on Contract DA 91-508-EUC-380. 30 Oct 59, 53p. 18 refs.
Order from LC mi$3. 60, ph$9. 30 PB 145 239

The present report summarizes a theoretical study on the horizontal visual range of not self-luminous objects under overcast sky. After a brief review on the definitions of brightness contrast, contrast threshold of the human eye, and visual range, the dependence of contrast threshold on the visual angle presented by a graph of H. R. BLACKWELL, is expressed analytically. Suitable substitution delivers a connection between visual range, extinction coefficient of the air, and luminances of both the object and the horizon. The luminance distribution of overcast sky is investigated. The results lead to the statement that the luminance distribution of overcast sky depends on the visual albedo of the underlying surface. The exact definitions of total and visual albedo are given, and calculated and measured values of them are presented. A "visual range function" is derived. It is discussed with respect to uniqueness, domain of definition, and zero points. The visual range function is described by means of several graphs showing the visual range plotted over the object albedo with ground albedo as parameter for different extinction coefficients, and vice versa. The theory is applied on visibility in polar regions. A brief description of the "polar whiteout" is given, and the optical phenomena of whiteout explained on the basis of our visual range theory. Finally some remarks are made with regard to future improvement and extension of the theory.

Naval Ordnance Test Station, China Lake, Calif.
OPERATIONAL PERFORMANCE OF THE CARY MODEL 14 SPECTROPHOTOMETER, by Charles E. Hathaway and Allen L. Olsen. 21 Aug 59, 50p. 1 ref. NOTS TP-2311; NAVORD rept. 6583.
Order from LC mi$3. 30, ph$7. 80 PB 145 629

The Cary Recording Spectrophotometer Model 14 is described briefly both as to photometric and electronic systems. Thorough performance and calibration checks have been made to evaluate the instrument and to provide calibration data for future checks. A detailed operating procedure for the Cary 14 to achieve maximum performance is given.

New York U., N. Y.
A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS, by J. H. Rohrbaugh. Scientific rept. no. 8, 1 June-31 Aug 59, on Contract AF 19(604)2673 [1959] 18p. AFCRC-TN-59-957.
Order from LC mi$2. 40, ph$3. 30 PB 145 651

An account is given of the procedures taken toward bringing the spectrometer to full operating condition. Using the frequency distributions given in the last report, the heat capacity is found for NaCl in the range from 2-100°K. (See also PB 144 969)

Office of Scientific Research and Development. Div. 16.
MEMORANDUM ON THE POLARIZATION-OPTICS OF THE PHOTOELECTRIC SHUTTER, by Hans Mueller (Mass. Inst. of Tech.). Rept. no. 2 on Contract OEMsr-576. 15 Nov 43, declassified 31 Mar 54: 50p. 2 refs. Div. 16. 4-18; OSRD rept. 3171; ATI-184-211.
Order from LC mi$3. 30, ph$7. 80 PB 146 130

This report discusses the theoretical aspects of the problem of the photoelastic shutter. In particular it is an investigation of the polarization-optical systems used in connection with this shutter and serves to determine the most favorable system to be used for attaining maximum range of transmission. The light transmitted by the shutter is in general a mixture of natural light and elliptically polarized light, i. e. so-called partially elliptically (abbrev. pe), or eventually partially linear (pl), or partially circular (pc) polarized light. This is true even if the shutter is illuminated with monochromatic linear (l), elliptical (e), or circular (c) polarized light. Since the mathematical tools necessary for the handling of problems involving partially polarized (pp) light appear to be little known, we start out discussion with a short exposition of these mathematical method.

Visibility Lab., U. of California, San Diego.
PHOTIC FIELD THEORY FOR NATURAL HYDROSOLS, by R. W. Preisendorfer. Rept. on Contract NObs-72092. 10 Sep 58, 20p. 5 refs. SIO Reference 58-66; AD-206 113.
Order from LC mi$2.40, ph$3.30 PB 145 259

An example of the application of the vector theory of the photic field (light field) to an important class of scattering-absorbing optical media, namely the class of natural hydrosols consisting of oceans, harbors, and lakes. The application is at the same time of practical value in that it yields explicit expressions for the depth-dependence of the light vector in terms of its components at the surface and certain of the optical properties of these media. The discussion presents particularly simple interpretations of the quasipotential and related functions. While the practical context limited specifically to that of natural hydrosols, the mathematical arguments apply equally to any arbitrary plane-parallel scattering-absorbing medium in which the light vector possesses a quasipotential. (Author)

Solid State Physics

Armour Research Foundation, Chicago, Ill.
ORGANIC SEMICONDUCTORS, by D. E. Laskowski, E. H. Tompkins, and O. W. Adams. Quarterly rept. for 15 Mar-15 June 59 on Contract AF 49(638)576. Dec 59, 43p. 12 refs. Rept. no. ARF-3142-1; AFOSR-TN-60-63.
Order from OTS $1.25 PB 161 459

A theoretical study was made of the various mechanisms and reactions which would lead to organic semiconductors. A series of experiments were also initiated to develop materials and to bolster theoretical conclusions. The usual approaches applicable to inorganic semiconductors fail for organic conductors because of their high resistivity and other factors. The study of donor-acceptor combinations has led to a whole series of possibilities. An organotin polymer was found to decrease in resistivity manyfold when treated with iodine. It shows interesting promise as an organic semiconductor.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A STUDY OF THE RELATIONSHIP BETWEEN THE FIRST COMPRESSIVE STRESS AND GROSS PLASTIC DEFORMATION IN EXPLOSIVELY LOADED COPPER, by G. Moss and C. Class. Sep 59, 28p. 4 refs. Memo. rept. no. 1236.
Order from LC mi$2.70, ph$4.80 PB 145 014

A copper single crystal in the form of a hollow cylinder was subjected to an internal explosion in an effort to determine whether or not strain markings are formed in the first very intense compression fronts developed in metals by explosions. Analysis of framing camera pictures and macrostructures indicates that slip and kink bands are not associated with this compression front, but develop later and are indications of the atomic movements in the metal which result in the final specimen shape. (Author)

Brown U., Providence, R. I.
INVESTIGATIONS OF SURFACE PROPERTIES OF SILICON AND OTHER SEMICONDUCTORS, PHASE I AND II, by H. E. Farnsworth, D. Haneman and others. Scientific rept. no. 1, 1 Oct-31 Dec 59, on Contract AF 19(604)5986. Jan 60, 24p. 16 refs. AFCRC-TN-60-128.
Order from LC mi$2.70, ph$4.80 PB 145 624

A comparison has been made of the structure of the surface of a bismuth-telluride crystal produced by cleaving in high vacuum with a similar surface prepared by the ion-bombarding and annealing technique. No observable adsorption of oxygen or carbon monoxide was found for any of the surfaces produced. Tests have been undertaken to determine the condition under which high-conductivity films appearing on heat-treated silicon can be produced and removed. (See also PB 138 890)

Compagnie Générale de Télegraphie Sans Fil (France).
RESEARCH ON RECOMBINATION PROCESSES IN SEMI-CONDUCTOR. Technical final rept. on Contract AF 61(052)100. [1959]. 11p. AFOSR-TR-59-37; AD-213 630.
Order from LC mi$2.40, ph$3.30 PB 145 039

A special cryostat and optical system were designed and built. This system is transportable and entirely non-magnetic. Experiments have now begun, but it is too early to report on results.

Cornell U., Ithaca, N. Y.
STUDIES ON THE SEPARABILITY OF SIZE EFFECTS IN ELECTRON DIFFRACTION FROM SINGLE CRYSTAL SURFACES, by Harold P. Furth, James A. Krumhansl, and Benjamin M. Siegel. Technical rept. no. 7 on Theoretical and Experimental Investigations of the Atomic Phenomena Occurring on and Near the Surfaces of Solids, Contract AF 18(600)674. 22p. 12 refs. AFOSR-[TN]-58-284; AD-154 188.
Order from LC mi$2.70, ph$4.80 PB 137 712

Reflection electron diffraction at low angles from very smooth surfaces of solids give an interface pattern which is produced by electrons scattered from only a few net planes of atoms parallel to the surface. An analysis is attempted of the information that can be obtained, conditioned by the nature of the investigations of surfaces by electron diffraction, of the character of the diffraction phenomena from these surface net planes. The relaxation of the Laue condition caused by the limited extent of the atomic arrays producing a given coherent interference will be the overriding factor in determining the type of diffraction pattern obtained from low angle electron diffraction from very smooth surfaces. The relaxation phenomena are analyzed through the use of a semi-dynamical model, which can lead to a method for investigating the possible lattice contraction of crystals in the surface planes.

Emerson and Cuming, Inc., Canton, Mass.
INVESTIGATION OF STANDARD AND ARTIFICIAL DIELECTRICS, by J. W. Lefforge. Rept. no. 4 (Final) on Contract AF 19(604)2448. [1958] 41p. 4 refs. AFCRC-TR-58-183; AD-160 834.
Order from LC mi$3.30, ph$7.80 PB 137 979

Controlled dielectric constant materials suitable for fabricating microwave lenses for elevated temperature service have been obtained using a structural low density matrix of fine borosilicate glass bubbles called Eccospheres. This matrix has been bonded by a number of different techniques and loaded with high dielectric constant materials to provide the desired dielectric properties. Pertinent properties of the best combinations are shown in the table. (Author)

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
STUDIES OF INDIVIDUAL DISLOCATIONS IN CRYSTALS BY X-RAY DIFFRACTION MICRORADIOGRAPHY, by A. R. Lang. Technical rept. no. 2 on Contract Nonr-1866(39). 5 Mar 59, 29p. 21 refs. AD-218 280.
Order from LC mi$2.70, ph$4.80 PB 145 215

The distribution of imperfections within the interior of crystals has been studied using "projection topographs" which are X-ray diffraction images showing a projection of a slice of crystal and the imperfections in it. Individual dislocations have been observed in single crystals of diamond, silicon, germanium, lithium fluoride, sodium chloride, silver chloride, magnesium oxide, calcite, quartz and aluminum. From the variation of dislocation contract with the orientation of the X-ray reflecting plane the direction of Burgers vector can be found. Dislocations can be seen with good contrast when the product of linear absorption coefficient (μ) and slice thickness (t) is of the order of unity or less. If $\mu t \gg 1$ the contrast is reversed through the Borrmann effect. Stereopairs of projection topographs can be prepared from the pair of reflections h k l and $\bar{h}\,\bar{k}\,\bar{l}$. (Author)

Institute of Engineering Research, U. of California, Berkeley.
CHEMICAL CONSIDERATIONS IN HIGH TEMPERATURE THERMOELECTRIC POWER DEVELOPMENT, by Alan W. Searcy and David J. Meschi. Technical rept. no. 6 on Contract Nonr-222(32). Mar 59, 32p. 49 refs. Series no. 84, issue no. 6.
Order from LC mi$3.00, ph$6.30 PB 145 076

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
SOME REMARKS ABOUT FREQUENCY SPECTRUM OF CRYSTAL LATTICES, by Jean Peretti. Rept. on Contract AF 18(600)1315. Aug 58, 37p. 12 refs. Technical note BN-145; AFOSR-TN-58-775; AD-201 921.
Order from LC mi$3.00, ph$6.30 PB 137 538

In this paper it is shown how to construct in a general way the frequency distribution of a crystal lattice when the force constants between atoms are known.

Institute of Optics, U. of Rochester, N. Y.
TRAPPED CHARGE AND THE LOW TEMPERATURE LUMINESCENCE OF UNDOPED KI, by K. Teegarden and R. F. Weeks. Technical note B 1 on Contract AF 49(638)433. 10 Nov 58, 18p. 8 refs. AFOSR-TN-58-918; AD-204 562.
Order from LC mi$2.40, ph$3.30 PB 137 845

This paper presents new data on the low temperature blue luminescence of undoped KI. It is shown that the emission previously observed during irradiation in the fundamental bands can also be stimulated by irradiation in the F. and F'- bands formed by exposure to ultraviolet light at 93°K. The crystals display a burst of red luminescence when warmed after irradiation with light absorbed in the fundamental bands at 93°K. No emission upon irradiation in the F-band at 93°K occurs if F-centers have been formed above the temperature of the thermal burst of red luminescence.

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
AN EXPERIMENT ON THE POSSIBLE DEPENDENCE OF SUPERCONDUCTIVE TRANSITION TEMPERATURE ON THE SURFACE CHARGE DENSITY, by Guido Bonfiglioli and Renato Malvano. Technical note no. 3a (supplemental) on Study of the Surface Electrical Conduction in Metals, Contract AF 61(514)1333. [1959] 10p. 2 refs. AFOSR-TN-59-1234.
Order from LC mi$1.80, ph$1.80 PB 145 673

The experiment has been performed through direct measurement of the resistance of a strip of lead. Pb becomes a superconductor above the temperature of liquid He under atmospheric pressure.

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
FURTHER INVESTIGATIONS ON THERMOLUMINESCENCE AND F CENTERS, by Guido Bonfiglioli, Piero Brovetto, and Cesare Cortese. Technical note no. 2d on Study of the Traps Distribution in Dielectrics or Semiconductors by Thermoluminescence Experiments, Contract AF 61(514)1333. [1959] 15p. 5 refs. AFOSR-TN-59-1126.
Order from LC mi$2.40, ph$3.30 PB 145 674

This note is concerned with further investigations both experimental and theoretical. The experiments consisted of the recording and analyzing of glow curves and separate peaks of light. (See also PB 137 477)

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
THEORY OF THE ISOTHERMAL BLEACHING OF F CENTERS PRODUCED BY IRRADIATION IN ALKALI HALIDES, by Guido Bonfiglioli, Piero Brovetto, and Cesare Cortese. Technical note no. 3d on Study of the Traps Distribution in Dielectrics or Semiconductors by Thermoluminescence Experiments, Contract AF 61(514)1333. [1959] 14p. 8 refs. AFOSR-TN-59-1315.
Order from LC mi$2.40, ph$3.30 PB 145 681

The same model used in the previous Techn. Notes to quantitatively interpret thermoluminescence of irradiated alkali halides, is applied in the present paper to account for the experimental results on thermal bleaching of the optical density in the same materials. The present calculation do fit remarkably well with experiment, showing that the presence of several species of V-Centers was actually responsible for the well known big interpretation difficulties which, so far, characterized this subject.

Massachusetts Inst. of Tech., Cambridge.
INTERACTIONS OF ELASTIC WAVES IN SOLIDS, by L. Van Hove and L. P. Howland. Technical rept. no. 11 on Contract Nonr-1841(34): 15 Mar 59, 101p. 21 refs.
Order from LC mi$5.70, ph$16.80 PB 145 384

Contents:
Interacting phonons in an ideal non-conducting crystal: Hamiltonian
The classical theory of lattice vibrations
Quantization of lattice vibrations; creation and annihilation operators
Formulation of the perturbation problem
Elements of the perturbation formalism
Results for the perturbed ground state
Derivation of results for the ground state
Scattering of neutrons by a crystal in its ground state: general discussion
Peaks in the energy spectrum of neutrons scattered at $0^{o}K$
Free energy of an anharmonic crystal
Scattering of neutrons by a crystal at an arbitrary temperature

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
THEORY OF D_O FOR RING SELF-DIFFUSION IN METALS, by G. M. Pound, W. R. Bitler, and H. W. Paxton. Rept. on Contract Nonr-760(08). [1959] 18p. 25 refs.
Order from LC mi$2.40, ph$3.30 PB 145 393

The kinetics of ring self-diffusion in metals is treated in terms of statistical mechanics from the viewpoint of absolute rate theory. It is concluded that there are synchronal contributions to the entropy and enthalpy of activation of all processes in solids which require a simultaneous, cooperative, and similar movement of n atoms.

Microwave Labs., Stanford U., Calif.
FERRIMAGNETIC RESONANCE IN POLYCRYSTALLINE YTTRIUM IRON GARNET, by P. E. Seiden. Technical note on Contract AF 49(638)415. Oct 59, 84p. 61 refs. M. L. rept. no. 657; AFOSR-TN-59-1186.
Order from LC mi$4.80, ph$13.80 PB 145 017

Samples ranged from 25 per cent iron excess through stochiometric proportions to 15 per cent yttrium excess. Firing atmospheres used were air, oxygen, nitrogen, and argon to obtain different states of sample oxidation. Ferrimagnetic resonance experiments were performed at 9317 Mc, and the linewidth, g-value and saturation curves of microwave susceptibility as a function of rf magnetic field strength were obtained. The x-ray diffraction data and photomicrographs show that no substitution occurred in the garnet lattice and all excess material went into ceramic second phases.

Naval Ordnance Test Station, China Lake, Calif.
A SURVEY OF SOLID-STATE LIGHT AMPLIFIERS AND ALLIED DEVICES, by Justin Ruhge. 20 Nov 59, 67p. 14 refs.
Order from OTS $1.75 PB 161 465

Literature on the phenomenon of electroluminescence, the photoconductive properties of CdS and CdSe, the electroflor phosphors, thin photoconductive films, and image tubes is reviewed. Three solid-state light amplifiers and their applications are discussed, as well as the application of electroflors and the electroluminescent lamp to plotting boards, X-ray screens, radar and television displays, relays, and to the digital display of analog information. The discussion emphasizes the development and application of the solid-state light amplifier, the electroflor, and the image tube as electronic shutters. Of these, the image tube is considered the most available commercially as an electronic shutter and for this purpose requires the least development. Both the solid-state light amplifier and the electroflors show much promise as shutters but their use as such requires further development. (Author)

Northwestern U., Evanston, Ill.
GRAIN BOUNDARY SLIDING VERSUS GRAIN BOUNDARY MIGRATION IN CREEP, by J. O. Brittain and N. R. Adsit. Rept. on Contract AF 18(600)1598. 23 Dec 59, 9p. 5 refs. AFOSR-TN-60-108; AD-231 829.
Order from LC mi$1.80, ph$1.80 PB 145 666

Creep tests on bicrystals of pure zinc showed that in zinc there is no explicit relation between the amount of grain boundary sliding and grain boundary migration. Observations made while the specimen were being tested indicate that part of the inactive periods of grain boundary sliding are due to grain boundary migration.

Ohio State U. Research Foundation, Columbus.
SPECIFIC HEATS OF METALS AND ALLOYS BELOW $1^{o}K$, by C. V. Herr. Final rept. on Contract AF 49(638)254. Nov 59, 11p. 10 refs. Rept. 795; AFOSR-TR-59-198.
Order from OTS $0.50 PB 161 461

The specific heat of a normal metal Na, a ferromagnetic metal Co, a ferromagnetic alloy Co_{93} Fe_7, an antiferromagnetic metal α-Mn, and an antiferromagnetic salt $Mn F_2$ have been measured in the temperature region between 0.4 and $2^{o}K$. A two-stage magnetic refrigerator isothermal enclosure for future studies between 0.03 and $0.3^{o}K$ was completed at the end of the contract. (Author)

Plastics Lab., Princeton U., N. J.
PRESSURE INDUCED CRYSTALLIZATION IN POLYETHYLENE, by S. Matsuoka and B. Maxwell. Rept. on Contract DA 36-039-sc-78105. 30 Apr 59, 92p. 45 refs. Technical rept. 53E.
Order from OTS $2.25 PB 161 455

By modifying the classical theory of phase transition a kinetic theory of crystallization involving chain molecules has been developed. The process of crystallization for high polymers has been found to be divisible into two stages; (1) primary crystallization where nuclei develop from randomly distributed "subembryos" and continue to grow until their further growth is restricted by the entangled amorphous regions and (2) secondary crystallization where crystallization of the remaining amorphous regions takes place through disentanglement.

Polytechnic Inst. of Brooklyn, N. Y.
COMPOUNDS WITH DEFECT LATTICES, by E. Banks. Final rept. for 1 June 56-31 Aug 57 on Contract DA 36-039-sc-71242. [1957] 113p. 47 refs. AD-149 732.
Order from LC mi$6.00, ph$18.30 PB 138 243

Variation in magnetic intensity of $BaFe_{12}O_{19}$ was studied as a function of the substitution of ions like Al^{III}, Ga^{III}, Cr^{III}, Zn^{II} for Fe^{III}. Mixtures of Na_2CO_3, ZnO, and Fe_2O_3 resulted in single phases with the spinel structure, which were strongly magnetic. On attempts at controlled growth of large single crystals of $NiFe_2O_4$ and $CoFe_2O_4$ from molten PbO, material was in the form of domains having lamellae of PbO and $CoFe_2O_4$. This may be an extremely large-grained eutectic crystallization. New ternary compounds have been found in the Cu-Fe-Se system. Solid solutions up to 5% $NaTaO_3$ in WO_3 have been prepared. Single crystals of CdF_2, containing additions of NaF, CeF_3, were grown from the melt. Physical constants of CdF_2 were measured. Large single crystals of $BaSO_4$ have been grown on platinum wires. The red fluorescence of $BaSO_4 \cdot BaS$ appears to be inherent in this system. (See also PB 138 207)

Rochester U., N. Y.
ON THE VARLEY MECHANISM FOR DEFECT FORMATION IN ALKALI HALIDES, by D. L. Dexter. Rept. no. 4 on Contract AF 49(638)432. Nov 59, 6p. 5 refs. AFOSR-TN-59-1255.
Order from LC mi$1.80, ph$1.80 PB 145 645

Discusses the Varley mechanism and several alternate concepts.

Royal Inst. of Tech. (Sweden).
ON THE CRYSTAL STRUCTURE OF TELLURIUM(IV) CATHECOLATE, by P. J. Antikainen and Georg Lundgren. Technical note no. 1 on Contract AF 61(052)162. 27 July 59, 12p. 7 refs. AFOSR-TN-59-661.
Order from LC mi$2.40, ph$3.30 PB 145 621

The crystals of $Te(C_6H_4O_2)_2$ are monoclinic. They contain 8 formula units per unit cell giving a calculated density of 2.10 g/ml. The tellurium arrangement in the crystals has been determined. Work on the determination of the positions of the oxygen and carbon atoms is in progress.

Rutgers State U., New Brunswick, N. J.
STEADY-STATE FREE PRECESSION IN NUCLEAR MAGNETIC RESONANCE, by H. Y. Carr. Rept. on Contract AF 18(603)06. 1 Sep 58, 26p. 12 refs. AFOSR-TN-58-1052; AD-206 984.
Order from LC mi$2.70, ph$4.80 PB 145 329

A steady-state free precession technique for observing nuclear magnetic resonance is described. A mathematical analysis is presented for certain special conditions, and initial experiments verifying the results of this analysis are reported. This technique provides two opportunities for improving the signal-to-noise ratio. First, it provides a mechanism, similar to that of the "spin echo," for eliminating the effect of the inhomogeneity of the magnetic field on signal strength. This permits the effective use of larger samples. In the second place it provides a steady-state signal which can be observed with a narrow-band detector. Under certain conditions the technique has a broad response as a function of frequency or field. The upper limit to the width of this response is determined by the electronic apparatus supplying the rf pulses rather than the magnet or the nuclear sample. (Author)

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
RESEARCH ON ELECTRON DENSITY DISTRIBUTION IN SEMICONDUCTORS, by J. R. Townsend, G. A. Jeffrey, and G. Panagis. Technical rept. on Contract DA 36-061-ORD-516. Aug 59, 46p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 145 702

Contents:
"The alignment of the general electric single crystal Orienter and diffractometer for single crystal intensity measurements" by J. R. Townsend, G. A. Jeffrey and G. Panagis
"The application of the general electric crystal orienter and counter diffractometer to crystal structure analysis", by G. A. Jeffrey
Report on the international union of crystallography commission on crystallographic apparatus conferences in Stockholm, June 9-12, 1959 on X-ray wavelength problems
Precision lattice parameter determination counter methods for crystal structure analysis

Stanford U., Calif.
ON THE ANOMALOUS LOSS OF RESOLUTION OF PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE IN LIQUIDS, by G. E. Pake and T. R. Tuttle, Jr. Technical note no. 2 on Contract AF 18(603)131. Oct 59, 7p. 9 refs. AFOSR-TN-59-1018.
Order from LC mi$1.80, ph$1.80 PB 145 305

Hausser (Z. Naturforsch. 14a, 425 (1959)) has recently observed a remarkable temperature dependence in the resolution of hyperfine splittings for paramagnetic molecules in liquid solution. Typically, he finds that increasing temperature from a point of high solvent viscosity ultimately brings out a well-resolved structure which surprisingly blurs and disappears at still higher temperatures. An explanation is proposed here for the anomalous loss of structure.

Stockholm U. (Sweden).
STUDIES ON THE CRYSTAL CHEMISTRY OF TITANIUM, VANADIUM AND ZIRCONIUM OXIDES AT ELEVATED TEMPERATURES, by Arne Magneli, Sten Andersson and others. Final technical rept. no. 1, 1 Oct 57-30 Sep 58, on Contract DA 91-508-EUC-245. 1 Oct 58, 99p. 19 refs. AD-157 156.
Order from LC mi$5.40, ph$15.30 PB 145 923

Three phases exist within the solubility range of oxygen in α-titanium, corresponding to random, partly ordered and ordered states respectively. The crystal structure of the so-called δ-titanium oxide is related to that of the ω-phases of several binary alloy systems containing titanium. Ti_3O_5 shows a rapid, reversible phase transformation at 100°C. The structure of V_3O_5 has been determined. When heated to 70°C, VO_2 of MoO_2-type structure undergoes a rapid, reversible transformation to a structure essentially of the rutile type.

Uppsala U. (Sweden).
ADDITION COMPOUNDS OF DIPHOSPHORUS TRIOXIDE TETRACHLORIDE, by Ingvar Lindqvist, Margareta Zackrisson, and Sigvard Eriksson. Technical note no. 5 on Contract AF 61(052)43. 17 July 59, 7p. 5 refs. AFOSR-TN-59-575; AD-217 022.
Order from LC mi$1.80, ph$1.80 PB 145 619

The formation of addition compounds with diphosphorous trioxide tetrachloride as donor molecule has been studied. The following new compounds have been prepared: $2SbCl_5 \cdot P_2O_3Cl_4$ and $SnCl_4 \cdot P_2O_3Cl_4$ and their infrared spectra have been recorded. (Author)

Uppsala U. (Sweden).
STUDIES ON MOLECULAR CRYSTALS. 1. EXCITATION IN A PURE CRYSTAL, by George G. Hall. Technical note no. 15 on Contract AF 61(514)1200. 1 Aug 58, 20p. 12 refs. AD-226 403.
Order from LC mi$2.40, ph$3.30 PB 145 186

The group velocity and the energy of excitation depend on the shape of the zone of excited states of the crystal. The problem of calculating this zone is considered and shown to involve a calculation of long range dipole interactions. The method of long waves is adapted to enable the nature of the excited states to be investigated further and it is shown that, in some circumstances, the excitation is like a longitudinal wave of polarization but that there is an electromagnetic wave coupled to the excitation as it moves.

Uppsala U. (Sweden).
STUDIES ON MOLECULAR CRYSTALS. 2. EXCITON STATES OF PURE CRYSTALS, by George G. Hall. Technical note no. 23 on Contract AF 61(514)1200. 1 Feb 59, 21p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 145 324

The problem of finding the exciton states of a pure molecular crystal is considered. In these states the positive and negative charges are separated but have a Coulomb attraction. The approximations involved in finding those states by the Wannier method of comparing with a hydrogen-like atom are discussed in some detail. Little movement of excitation is likely in these states until the charges are dissociated from one another. To illustrate the accuracy of the Wannier approximation the exciton states of a linear lattice of molecules are found by two methods. An exact solution of the difference equations can be obtained and the eigenvalues have a simple closed form. The Wannier solution gives very similar eigenvalues when the principle quantum number is large or if the effective charge is small and they can be improved by adding a first order perturbation correction. (Author)

Uppsala U. (Sweden).
TOWARDS A THEORY OF THE CRYSTALLOGRAPHIC POINT GROUPS, by Harold V. McIntosh, Technical note no. 21 on Contract AF 61(514)1200. 3 Nov 58, 23p. AD-218 832.
Order from LC mi$2.70, ph$4.80 PB 145 326

Summary is made of the theorems to be expected in a comprehensive theory of both the double and single crystallographic point groups. Based upon their decomposition as semi-direct products, it is shown how the theory may yield a nomenclature for the groups and their representations, and a factored form for the projection operators belonging to the rows of the irreducible representations. This factorization is used to discuss the reduction of spherical harmonics according to their point group symmetry, as well as to discuss normal coordinate analyses, the construction of symmetric Hamiltonians, and the derivation of selection rules. The selection rules follow from the reduction of Kronecker product representations. The equivalence of complex conjugate representations and the construction of unitary representation is discussed. The entire analysis is predicated upon a certain canonical form for the representation of a semi-direct product, which is described. (Author)

Westinghouse Electric Corp., Youngwood, Pa.
RESEARCH IN THE PREPARATION OF HYPER-PURE SINGLE CRYSTAL SILICON CARBIDE. Scientific rept. no. 5, 29 Aug 58-30 June 59, on Contract AF 19(604)2174. [1959] 46p. 11 refs. AFCRC-TN-59-792.
Order from LC mi$3.30, ph$7.80 PB 145 370

Preparation and properties of pure silicon carbide: Extensive experiments have been carried out on the preparation of single crystals of SiC in a graphite tube furnace, after the method of Lely. A wide range of ambients have been employed. Crystals have been grown in argon, hydrogen, and over a wide range of

temperatures. Emphasis is laid upon the relationship between these variables and the composition and habit of the material grown. Interferometric determination of twist and polytype in silicon carbide whiskers: Whiskers of hexagonal SiC have been prepared in a graphite tube furnace. They are grown by sublimation of SiC in hydrogen, depositing at temperatures about 2000°C as acicular crystals of hexagonal section, with [0001] along the whisker length. The $(1\bar{1}00)$ faces have been examined using optical interference techniques, and are found to exhibit a twist. The Eshelby formula for twist caused by a screw dislocation has been used to estimate the strength of the associated Burgers vector. It is found that, within the experimental error, the estimated Burgers vector is equal to, or is an integral multiple of the unit cell of the SiC polytype 4H. It is thus concluded that these twisted whiskers grow by means of a screw dislocation of integral strength parallel to the axis, and that they are of polytype 4H. (Author)
(See also PB 140 092)

Theoretical Physics

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
PLASMA PROPULSION BY A RAPIDLY VARYING MAGNETIC FIELD, by M. M. Klein and K. A. Brueckner. Rept. on Contract AF 04(647)269. 2 Dec 59, 51p. 7 refs. Technical Information Series R59SD453.
Order from LC mi$3.60, ph$9.30 PB 145 704

The motion of a plasma driven by a rapidly varying magnetic field from a stationary coil have been investigated for (1) the diamagnetic case (ionization process ignored) and (2) non-diamagnetic case.

Air Force Cambridge Research Center, Bedford, Mass.
HYDRODYNAMIC MODEL OF DIFFUSION EFFECTS ON SHOCK STRUCTURE IN A PLASMA, by O. W. Greenberg, H. K. Sen, and Y. M. Trèves. Dec 59, 48p. 12 refs. Geophysical Research Papers no. 66; AFCRC-TR-59-278.
Order from OTS $1.25 PB 161 522

Diffusion effects on the structure of a steady, plane shock in a proton-electron plasma have been studied using a simplified, two-fluid, hydrodynamic model in which diffusion is the only shock-broadening mechanism. Charge separations occur inside the shock because of the mass difference between protons and electrons. The shock is shown to have electric field and density oscillations as a function of distance through the shock. The peak electric fields are large; the peak electric field inside a weak shock of Mach 1.169 reaches 41,700 volts/cm for typical quiescent plasma conditions. The distance in which electric field changes occur is of the order of the Debye length of the quiescent plasma. The present work is limited to shocks of Mach number less than 2. (Author)

Avco-[Everett] Research Lab. [Mass.]
TWO-DIMENSIONAL INCOMPRESSIBLE MAGNETOHYDRODYNAMIC FLOW ACROSS AN ELLIPTICAL SOLENOID, by Nelson H. Kemp and Harry E. Petschek. Rept. on Contracts AF 04(645)18 and AF 49(638)61. Apr 58, 74p. 7 refs. Research rept. 26; AFOSR-TN-58-438; AD-158 243 and AD-159 613.
Order from LC mi$4.50, ph$12.30 PB 137 763

An analysis has been made of the two-dimensional flow of an incompressible, constant-conductivity fluid through an elliptically-shaped solenoid containing a constant magnetic field directed normal to the flow plane. The effect of both Hall current and ion slip has been included in the Ohm's Law used for the fluid. The analysis was performed by means of a perturbation procedure in two parameters, one being the magnetic Reynolds Number R_m and the other the ratio of magnetic force per unit area to dynamic pressure, S. Calculations were carried through first order in each parameter, and closed-form analytic expressions were obtained for the force and moment on the solenoid, the current density, stream function, magnetic field and other pertinent physical quantities. It was found that in zero order, there is a force but no moment on the solenoid. In the first order in S, where the flow field changes but the magnetic field does not, there is a moment and a force, the latter being antiparallel to the zero order force. In the first order in R_m, where the magnetic field changes but the flow field does not, there is a moment, but no force. Thus, through first order the lift to drag ratio is the same as in zero order. Graphs are presented which illustrate some of the effects of angle of attack, fineness ratio of the ellipse, Hall current and ion slip on the forces and moments. (Author)

California U., Berkeley.
FUNDAMENTALS OF THE POLAR METHOD IN GAS WAVE DYNAMICS, by R. A. Stern and A. K. Oppenheim. Technical note DR 5 on Contract AF 49(638)166. Nov 59, 104p. 37 refs. AFOSR-TN-59-1152.
Order from LC mi$5.70, ph$16.80 PB 145 544

Gas wave dynamics is concerned with the analysis of interactions between waves propagating in compressible and reacting media. Multiple interactions, such as those occurring in shock tubes or during the development of detonation, require solutions "in the large", that is by means of analysis which considers only the compatibility conditions for the wave system resulting from each interaction without any regard for the details of its progress. These dynamic boundary conditions are expressed in terms of invariance relations between equilibrium states across each component wave. For the solution of the wave system they have to be pieced together, either numerically by an iterative procedure, or graphically by the polar method. The present work introduces the fundamentals of the polar method, which consists of the formulation of the basic problem leading to the establishment of invariance relations in the general case of a wave process, the derivation of invariance relations for an elementary wave process in the general case of a compressible and reactive medium, and the illustration of the analysis by the derivation of invariance relations for two special cases of simple waves: one with friction and the other with chemical reaction.

Dugway Proving Ground, Utah.
ON THE STRUCTURE OF HYDRODYNAMIC AND ELECTRODYNAMIC FIELDS. PART I: VECTOR EXPANSIONS IN RECTANGULAR COORDINATES, by Keith L. McDonald. Aug 59, 42p. 5 refs. Technical rept. DPGR 240.
Order from LC mi$3.30, ph$7.80 PB 145 697

In a previous paper the author discussed the linear component fields appearing in the Taylor expansion of an arbitrary solenoidal vector. The present work complements these fields to include those vectors with a non-vanishing divergence. The second and third order fields are treated extensively for both the solenoidal and divergence cases. A general scheme for treating higher order fields is also presented. Field structures are pictorially elucidated by means of figures showing vector lines of force. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
A SHALLOW-LIQUID THEORY IN MAGNETOHYDRODYNAMICS, by L. E. Frankel. Rept. on Contract AF 49(638)476. June 59, 77p. 18 refs. OSR Technical note 59-563; AD-216 758.
Order from LC mi$4.50, ph$12.30 PB 145 299

The nonlinear and linear shallow-water theories, which describe long gravity waves on the free surface of an inviscid liquid, are extended to the case of an electrically conducting liquid on a horizontal bottom, in the presence of a vertical magnetic field. The dish holding the liquid, and the medium outside it, are assumed to be non-conducting. The approximate equations are based on a small ratio of depth to wavelength, on the properties of mercury, and on a moderate magnetic field strength. These equations have a magneto-hydraulic character, for in the shallow liquid layer the horizontal fluid velocity and current density are independent of the vertical coordinate. Some explicit solutions of the linear equations are obtained for plane flows and for axi-symmetric flows in which the velocity vector lies in a vertical, meridianal plane. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
RAYLEIGH'S PROBLEM IN A TRANSVERSE MAGNETIC FIELD, by Hsun Tiao Yang. Rept. on Contract AF 49(638)401. Dec 58, 19p. 4 refs. Technical note BN-158; AFOSR-TN-59-47; AD-209 418.
Order from LC mi$2.40, ph$3.30 PB 145 567

Rayleigh's problem of an infinite flat plate set impulsively into uniform motion in its own plane, in the presence of a transverse uniform magnetic field, is studied in the present note. The fluid is assumed to be an incompressible continuum, and the plate electrically non-conducting. Two limiting cases are discussed somewhat in detail (1) The magnetic field is very weak. In this case it is found that the flow field is only slightly perturbed from the classical Rayleigh's result. (2) The magnetic field is very strong. Here the flow field is greatly influenced by the magnetic field. An Alfven wave, propagating at high speed in the direction of the magnetic field, gives rise to a small discontinuity in the flow velocity at the wave front.

Institute of Theoretical Physics, Stanford U., Calif.
PION-PION SCATTERING IN THE φ^4 THEORY, by M. Baker and F. Zachariasen. Technical note no. 9 on Contract AF 49(638)388. Dec 59, 25p. 5 refs. AFOSR-TN-59-1324.
Order from LC mi$2.70, ph$4.80 PB 145 642

Pion-pion scattering has been calculated using the determinantal method, assuming that a relativistic $(\lambda/4)(\varphi_i \varphi_i)^2$ coupling is responsible for the interaction. The scattering amplitude for the individual partial waves is expressed as a ratio of two power series and terms through λ^3 have been kept in each series. Numerical results for the S- and P-waves have been obtained. λ is adjusted by attempting to fit the electromagnetic structure of nucleons. The best value of λ obtained by this fit is unfortunately so large that the validity of the determinantal approximation is doubtful. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
SOME REMARKS ON COMPTON SCATTERING, by J. D. Walecka. Technical note no. 8 on Contract AF 49(638)388. Dec 59, 16p. 8 refs. AFOSR-TN-59-1332.
Order from LC mi$2.40, ph$3.30 PB 145 640

As of the present time, no successful theory of nuclear Compton scattering exists. The best attempts at a theory combine the amplitude for the scattering of photons by a Dirac particle with a point anomalous moment (this amplitude is known to be exact in the low-energy limit) with an amplitude which attempts to take into account the internal structure of the nucleon. In this note, the first, or "Powell amplitude," is presented in a form which is useful in such calculations. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
X-RAY INCOHERENT SCATTERING FUNCTIONS FOR NON-SPHERICAL CHARGE DISTRIBUTIONS. II. Ti^{+2}, V^{+2}, Mn^{+2}, Mn AND Fe, by A. J. Freeman. Nov 59, 18p. 14 refs. MRL Rept. no. 68.
Order from LC mi$2.40, ph$3.30 PB 145 631

Compton incoherent scattering functions have been calculated for the transition elements, Ti^{+}, V^{+2} Mn^{+2}, Mn^{+}, Mn and Fe using available Hartree-Fock free atom wave functions. The methods reported earlier for including the effects of non-spherical charge distributions on the scattering function have been employed in these calculations as well. In agreement with previous results, large differences are found from the values of James & Brindley, due mainly to the inclusion of all the exchange terms in the Waller-Hartree theory. (Author) (See also PB 139 657)

Microwave Lab., Stanford U., Calif.
INTERPRETATION OF THE RESULTS OF THE RF CONFINEMENT EXPERIMENT, by P. A. Sturrock. Scientific rept. no. 3 on Contract AF 19(604)5226. Oct 59, 30p. 8 refs. M. L. rept. no. 638; AFCRC-TN-59-787.
Order from LC mi$2.70, ph$4.80 PB 145 289

The results of certain experiments upon the confining action of low frequency (about 10 Mc/s) rf fields upon plasmas are reviewed. Attempts at theoretical explanation of these results by various confinement mechanisms also are reviewed. The theories are not found acceptable, and there are certain general reasons for believing that the experiments do not represent true confinement. Investigation of the electric field configuration necessary to explain the observed plasma configuration leads one to interpret the experiment in terms of "pseudo-confinement". Surface charges build up on the inner wall of the glass tube in such a way that electrons experience a radially inward force at the surface of the plasma over almost all of the surface of the plasma almost all of the time; ions therefore experience an outward force almost everywhere most all of the time. The effect of the rf electric field is therefore to promote the formation of a high-voltage sheath separating the plasma from the glass tube. This interpretation appears to be fully compatiable with observations so far made with various electric-field patterns; it also offers an explanation of the dark deposits on the glass tube noted in certain experiments. Further experiments which may be conducted to verify this theory are proposed. (Author)

Microwave Lab., Stanford U., Calif.
A PARAMETRIC AMPLIFIER THEORY FOR PLASMAS AND ELECTRON BEAMS, by G. S. Kino. Scientific rept. no. 14 on Contract AF 19(604)1930. Sep 59, 28p. 5 refs. AFCRC-TN-59-776; ML rept. no. 636.
Order from LC mi$2.70, ph$4.80 PB 145 652

The theory of a new type of parametric amplifier which uses a gas discharge plasma as a nonlinear propagating medium is given. This theory is based on a zero temperature plasma assumption. The nonlinear coupling between traveling waves passing through the plasma is determined by taking second-order terms in the velocity into account. A simplified normal mode theory is used to describe the effect on the propagation constants of the individual modes due to coupling between them. The theory is carried out in detail for a plasma in an infinite magnetic field and for a plasma in a zero magnetic field. The final propagation equation for the traveling waves is found in terms of the fields in the plasma of the small-signal pumping wave, signal wave and idler wave. In the appendix the theory is extended to cover the case of beam-type parametric amplifiers. The results obtained are in agreement with the theory of Louisell and Quate for the principal waves of a space-charge wave parametric amplifier.

Oslo U. (Norway).
THEORETICAL RESEARCHES IN MAGNETO-HYDRODYNAMICS, by Øivin Holter, Eberhart Jensen and others. Technical (final) rept. on Contract AF 61(052)49. 30 June 59, 19p. AFOSR-TR-59-92; AD-219 370.
Order from LC mi$2.40, ph$3.30 PB 145 665

The subjects covered are plasma oscillations in the classical sense; general theory of wave propagation in a plasma; the form and importance of viscous forces in plasma phenomena when magnetic fields are active; plasma shock waves; and forces in a plasma conditioned by certain deviations from thermal equilibrium, in particular deviations from equipartition of kinetic energy. (Author)

Uppsala U. (Sweden).
SYMMETRY-ADAPTED FUNCTIONS BELONGING TO THE SYMMETRIC GROUPS, by Harold V. McIntosh. Technical note no. 19 on Contract AF 61(514)1200. 6 Oct 58, 24p. 19 refs.
Order from LC mi$2.70, ph$4.80 PB 145 327

Young's factorization of the idempotents belonging to the symmetric groups is given a necessary and sufficient characterization, by means of a lemma due to Burrow. The use of these idempotents is contrasted with Yamanouchi's representation, and finally the equivalence of Löwdin's path-diagram method to the group-theoretical treatment of the angular momentum states arising from the coupling of an assemblage of spin 1/2 particles is demonstrated. (Author)

Thermodynamics

Armour Research Foundation, Chicago, Ill.
THE DEVELOPMENT OF THERMOCOUPLES FOR TEMPERATURES IN THE REGION OF 1600° TO 2000°C, by Gary Steven and Walter C. Troy. Final rept. on Subcontract to Contract [DA 36-039-sc-2004] 18 Sep 50, 122p. 50 refs. NEPA 1580; ATI-155 272.
Order from LC mi$6.30, ph$19.80 PB 137 512

Thermocouples representing combinations of tungsten, molybdenum, tantalum, platinum, rhodium, iridium and alloys of these metals. In a neutral atmosphere, optimum properties and performance were obtained with the tungsten/iridium thermocouple. Alumina was selected among the pure oxide refractories for the protection of the w/Ir thermocouple. The Ir/60% Ir, 40% Rh thermocouple required no protective shielding for temperature measurements in oxidizing atmosphere.

Battelle Memorial Inst., Columbus, Ohio.
THERMAL PROPERTIES OF MATERIALS AT ELEVATED TEMPERATURES, by Herbert W. Deem, Webster D. Wood, and Charles F. Lucks. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5849. Dec 59, 22p. 1 ref. WADC Technical note 59-215.
Order from OTS $0.75 PB 161 478

Apparatus was designed and assembled for making linear-thermal-expansion, specific-heat, and thermal-conductivity measurements to 5000 F or above on metals and ceramic-type materials. Linear-thermal-expansion and specific-heat measurements are made in the same apparatus using the same specimen. Expansion measurements are made by directly viewing fiducial marks on a cylindrical specimen with two telemicroscopes. Specific-heat measurements are

made by measuring the heat input to an inner heater which is required to heat the specimen of known mass over a measured temperature range. Thermal-conductivity measurements are made by a radical heat-flow method using a thick-walled-cylindrical specimen with an encircling graphite heater. The apparatus are essentially completed and are ready for calibration. No measurements are reported. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
STEADY FLOW OF SLIGHTLY VISCO-ELASTIC FLUIDS, by W. E. Langlois and R. S. Rivlin. Technical rept. no. 3 on Contract DA 19-020-ORD-4725. Dec 59, 109p. 10 refs. DA-4725/3. OOR rept. 1271. 27-M.
Order from LC mi$5.70, ph$16.80 PB 145 365

A number of problems concerning flow of an incompressible slightly-viscoelastic fluid are discussed. There are: flow through a straight pipe of elliptical cross-section; flow in a converging channel formed by two infinite planes; and convergent flow in a conical vessel. Inertial forces are systematically neglected. (Author)

California U., Berkeley.
STATISTICAL STUDY OF ACCELERATING FLAMES: ANALYSIS OF VARIANCE, by R. A. Stern, A. J. Laderman, and A. K. Oppenheim. Technical note DR 6 on Contract AF 49(638)166. Nov 59, 79p. 12 refs. AFOSR-TN-59-1171.
Order from LC mi$4.50, ph$12.30 PB 145 637

Study of velocity fluctuations observed by means of ionization probes during the development of detonation reveals its significance as an indicator of physical characteristics of the flame. The results of the study are used to establish the requirements for more detailed, systematic investigation of the fluctuating characteristics of accelerating flame fronts.

Duke U. [Durham, N. C.]
THE STEADY-STATE THERMOELASTIC PROBLEM FOR THE ELASTIC LAYER RESTING ON A RIGID FOUNDATION, by I. N. Sneddon and F. J. Lockett. Rept. on Contract AF 18(600)1341. Sep 59, 12p. 4 refs AFOSR-TN-59-1291.
Order from LC mi$2.40, ph$3.30 PB 145 508

Naval Ordnance Test Station, China Lake, Calif.
APPLICATION OF A SINGLE PROBE FOR DERIVATIVE DIFFERENTIAL THERMAL ANALYSIS, by Jack M. Pakulak, Jr. 1 Sep 59, 18p. 4 refs. NOTS TP 2315; NAVORD rept. 6586; AD-227 047.
Order from LC mi$2.40, ph$3.30 PB 145 279

The application of an RC network to thermal analysis makes possible the use of a less complicated apparatus containing a single thermal sensing element. The described apparatus is particularly sensitive in studying the thermal physical aspects of a material under investigation. In this case the endo-exothermic peak area or height is proportional to the rate of change for that particular reaction rather than to the concentration. The apparatus is very sensitive and simple with non-critical components being used for the most part. The data obtained from the use of this apparatus are reliable and accurate in the temperature range considered valid for glass enclosed thermistors. Its practical application is shown by the qualitative determination of transition points for certain inorganic and organic compounds and the possibility of its incorporation into future kinetic studies. (Author)

Purdue U., Lafayette, Ind.
HEAT TRANSFER FROM NON-ISOTHERMAL SURFACES, by Helmut Wolf. Rept. on Project Squid, Contract Nonr-1858(25). Apr 59, 26p. 10 refs. Squid Technical rept. PUR-38-P.
Order from LC mi$2.70, ph$4.80 PB 145 380

Heat transfer experiments conducted in circular tubes having variations in wall temperature with axial distance are corrected to conditions of constant tube wall temperature by employing a form of the theory due to Rubesin for flat plates. The corrected results are compared with experiments wherein the wall temperature was held constant with respect to axial distance.

Wave Propagation

Boston Coll., Chestnut Hill, Mass.
ABSORPTION OF ULTRASONIC ENERGY IN LIQUIDS, by Frederick E. White. Final rechnical rept. for 2 Feb 53-1 Dec 56 on Contract DA 19-020-ORD-2569. [1956] 41p. 37 refs. OOR rept. 674.1 P; AD-118 798.
Order from LC mi$3.30, ph$7.80 PB 138 419

The purpose of the research was to attempt to obtain reliable data on the absorption of ultrasonic energy in various liquids over as wide as possible ranges of both frequency and temperature, and then to consider the significance of the data. Several liquids have been used, with the most study being given to ethyl acetate. A major portion of the time spent on this project has been in the endeavor to develop apparatus capable of yielding reliable data in a reasonable time. Practically none of the apparatus in use at the beginning of the project is now being used, changes having been made in almost every part.

Brown U. Div. of Engineering, Providence, R. I.
THE DIFFRACTION OF AN ACOUSTIC OR ELECTRO-MAGNETIC PULSE BY A RESISTIVE HALF-PLANE, by V. M. Papadopoulos. Rept. on Contract AF 19(604)4561. Oct 59, 38p. 2 refs. Scientific rept. AF 4561/6; AFCRC-TN-59-793.
Order from LC mi$3.00, ph$6.30 PB 145 288

The two dimensional wave diffraction problem, acoustic or electromagnetic, in which a pulse of step-function time dependence is diffracted by a resistive half-plane is solved by assuming dynamic similarity in the solution. (Author)

Columbia U. School of Engineering, N. Y.
A TRANSPORT EQUATION FOR THE SPECTRAL DENSITY OF A MULTIPLY SCATTERED ELECTROMAGNETIC FIELD, by Dmitri S. Bugnolo. Technical rept. T-3/D on Contract AF 49(638)350. 19 Nov 59, 27p. 19 refs. CU-8-59-AF-350-EE; AFOSR-TN-59-1175.
Order from LC mi$2.70, ph$4.80 PB 145 315

The use of a first Born approximation is open to question when the path length is greater than a mean free path in the scattering region. It is therefore of interest to develop a transport equation capable of predicting the spectral density for such cases. The general theory presented in this paper is applied to the case of multiple scattering by dielectric noise. It is independent of models for the dielectric fluctuations. A method of solution is developed for the case of forward scattering. The particular case of a monochromatic plane wave incident of a half space is discussed in detail. The results are applied to a numerical example in the troposphere. (Author)

Columbia U. School of Engineering, New York.
ON THE QUESTION OF MULTIPLE SCATTERING IN THE TROPOSPHERE, by Dimitri S. Bugnolo. Technical rept. T-4/D on Contract AF 49(638)350. 19 Nov 59, 23p. 18 refs. CU-9-59-AF-350-EE; AFOSR-TN-59-1252.
Order from LC mi$2.70, ph$4.80 PB 145 555

A criteria is developed to serve as a measure of multiple scattering in the troposphere as a result of dielectric noise. The question to be answered is: What is the probability that any ray of the incident field will be scattered at least twice in a distance R? This is a useful criteria in that it can be used as a measure of reliability for the usual single scatter approximations. The criteria is developed in detail for an arbitrary dielectric noise and applied to a number of special cases. The results indicate that multiple scattering effects should be of importance in the microwave spectrum. (Author)

Cornell U., Ithaca, N. Y.
THEORY OF SCATTERING OF X-RAYS AT ULTRA-SMALL ANGLES, by A. W. K. Metzner and L. G. Parratt. Technical rept. no. 15 on Contract AF 18(600)300. 14 Sep 58, 30p. 57 refs. AFOSR-TN-58-780; AD-202 001.
Order from LC mi$2.70, ph$4.80 PB 137 537

The present study represents a survey and discussion of small-angle scattering theory with an attempt in particular to clarify the picture in the ultra-small-angle region. It will be seen that interparticle interference effects play a dominant role here. On the other hand it will also be seen that no theory based on just the single scattering process can predict the experimental scattering curve correctly in this region, and multiple scattering theory has not yet been developed to the point where interparticle interference effects are taken into account.

Cruft Lab., Harvard U., Cambridge, Mass.
THEORETICAL AND EXPERIMENTAL STUDY OF THE BACK-SCATTERING CROSS SECTION OF AN INFINITE RIBBON, by Michael S. Macrakis. Scientific rept. no. 2, series 2 on Contract AF 19(604)4118. 5 June 59, 19p. 11 refs. AFCRC-TN-59-788.
Order from LC mi$2.70, ph$4.80 PB 145 579

The geometrical optics approximation is derived for the back-scattering cross section per unit length of an infinite ribbon. A comparison is made with the exact theory, the approximate theory of Sommerfeld, the variational method, and with experimental results obtained through the space-separation method for the measurement of back-scattering cross sections in a parallel-plate region.

Electrical Engineering Research Lab., U. of Texas, Austin.
AN ANALYSIS OF RADIOSONDE EFFECTS ON THE MEASURED FREQUENCY OF OCCURRENCE OF DUCTING LAYERS, by N. K. Wagner. 1 Dec 59, 38p. 15 refs. Rept. on Contract AF 19(604)2249. Rept. no. 6-31; AFCRC-TN-59-967.
Order from LC mi$3.00, ph$6.30 PB 145 286

The influence and importance of radiosonde sensing element time lag, data transmission techniques and significant level selection criteria on the resulting computed index of refraction profile are discussed. Time lag is found to be the most important single effect with data transmission techniques next in importance. Significant level criteria have a very small effect on ducting layer detection, and when considered in combination with time lag and data transmission techniques, are negligible. The quantitative importance of these radiosonde effects on ducting layer detection for the Southern California coastal region is determined by employing a refractometer profile data sample along with known and assumed characteristics for the radiosonde. A comparison is also made between layer frequency of occurrence statistics obtained from refractometer and radiosonde data for this geographical area. (Author)

Electrical Engineering Research Lab., U. of Texas [Austin]
RADIO PROPAGATION MEASUREMENTS IN THE 100-118 KMCS SPECTRUM, by C. W. Tolbert, C. O. Britt, and J. H. Douglas. Rept. on Contract Nonr-375(01). 15 Apr 59, 24p. 5 refs. Rept. no. 107.
Order from LC mi$2.70, ph$4.80 PB 145 695

This report describes the measuring technique and the results of propagating millimeter wavelengths between the frequencies of 100 and 118 kmcs over a 2155 foot path. The attenuation measured at these frequencies are best fit by a 2.53 mm oxygen line having a strength of 1.7 db/km and a line breadth constant of

0.045/cm/atmos. The water vapor attenuation measured indicates the presence of an absorption line resonant at 108.8 kmcs with a strength of 0.35 db/km and a line breadth constant of 0.075/cm for a standard sea level atmosphere. There was also evidence, particularly in the region of 100 to 106 kmcs, of absorption that can be explained only by some of the rare atmospheric gases such as N_2O, NO_2, SO_2 and O_3. (Author)

Electronics Research Lab., U. of California, Berkeley.
SCATTERING OF MICROWAVES BY FIGURES OF REVOLUTION, by J. S. Honda, S. Silver and F. D. Clapp. Rept. on Contract N7onr-295(29). 16 Mar 59, 40p. 11 refs. Rept. no. 84; Series no. 60, Issue no. 232; AD-216 595.
Order from LC mi$3.00, ph$6.30 PB 145 499

The image-plane (half-space) technique for measuring back scattering cross-sections as a function of aspect, and the azimuthal pattern of the scattered field of a target for a given aspect presented to the incident wave, for targets that are figures of revolution is described. The technique has been developed to yield results of a high degree of accuracy. The accuracy and precision are especially high for back scattering across sections where by a process of measuring return as a function of transmitter-receiver to target distance the background reflections can be eliminated and the true far zone cross section can be identified.

Geophysical Inst., U. of Alaska, College.
ARCTIC PROPAGATION STUDIES AT TROPOSPHERIC AND IONOSPHERIC MODES OF PROPAGATION, by Leif Owren, H. F. Bates and others. Final rept. on Contract AF 19(604)1859. Oct 59, 134p. 31 refs. AFCRC-TR-59-366.
Order from LC mi$6.90, ph$21.30 PB 145 560

Two types of direct scatter from the F region are identified on the records from the oblique incidence sweep-frequency sounder located at College, Alaska. One type of echo appears to come from randomly distributed, field-aligned irregularities in the ionosphere and the other from discrete patches of irregularities. Certain phenomena frequently recorded on high latitude ionograms such as Spread F and triple splitting are probably manifestations of backscatter from ionospheric irregularities. Fixed frequency oblique incidence soundings on frequencies of 12, 18 and 30 mc/s made at College, Alaska show both direct backscatter from the E and F layers and F layer propagated backscatter from the ground. Direct backscatter from the E layer (1E echo) occurs in the range interval of 200 to 800 km with a maximum between 300 and 500 km. F layer propagated backscatter from the ground (2F echo) is investigated using both the 12 mc/s 1956 soundings and soundings on 12, 18 and 30 mc/s obtained during 1958. A technique of estimating the electron densities of the outer ionosphere by the use of nose whistlers is described. The mathematical theory of longitudinally propagated whistlers in a magnetic dipole field is developed. Five short-term transpolar transmission tests conducted jointly by the Geophysical Institute and the Norwegian Defence Research Establishment during 1956-59 are described briefly.

Georgia Inst. of Tec.. Engineering Experiment Station, Atlanta.
METEOR BURST PROPAGATION, by W. B. Jones and J. B. Berry. Final rept. on Contract AF 19(604)5187. 30 Sep 59, 100p. 3 refs; AD-230515. AFCRC-TR-59-357.
Order from LC mi$5.40, ph$15.30 PB 145 300

Duty cycle as a function of receiver decision level and the distribution of echo decay time constants have been studied by analyzing propagation data obtained from the operation of two typical meteor-burst radio links utilizing two frequencies in the VHF spectrum. This study concludes that the duty cycle relationship is exponential for echoes reflected from underdense meteor trails with an exponent value which agrees with theory and previous observations of meteoritic mass distribution. As a consequence of this fact, a meteor-burst communication system's average information rate may be maximized by using wide band-width and a high instantaneous information rate. The distribution of echo decay time constants has been measured at two critical times of day. Empirical values were obtained for the median decay constant on each frequency. The predicted diurnal variation in this distribution has been confirmed and evaluated. The effects of path geometry and antenna patterns on the rate of occurrence of detectable radio-wave reflections from ionized meteor trails are considered from a theoretical point of view. The use of an electronic digital computer to predict meteor rates is described. An example computation showing how this technique is used to select antenna parameters is presented and discussed. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
TRANSCENDENTAL EQUATIONS IN ELECTROMAGNETIC THEORY, by Leon Kotin and Wilhelm Magnus. Rept. on Contract AF 49(638)229. Aug 58, 40p. 3 refs. Research rept. no. BR-27; AFOSR-TN-58-749; AD-201 501.
Order from LC mi$3.00, ph$6.30 PB 138 062

The problem of determining the zeros of the Hankel function $H_\nu^1(x)$ for fixed real x and variable (complex) ν plays a role in propagation theory and in the theory of diffraction by a metallic sphere. The equation $H_\nu^1(x) = 0$ defines ν as a function of x. The qualitative behavior of this function (for $x>0$) is determined for all $x \geq 1/4$. Complex values of x are also considered. In the case of a sphere of finite conductivity, the corresponding transcendental equation is similarly treated. (Author)

Menzel, Donald H., Cambridge, Mass.
INTERACTION OF ELECTROMAGNETIC AND ACOUSTIC WAVES IN AN IONIZED MEDIUM [and] A DYNAMICAL MODEL FOR STELLAR ATMOSPHERES, by Donald H. Menzel, David Layzer, and Max Krook. Final rept. no. 1 on Contract AF 19(604)3897. 15 Mar 59, 7 refs. AFCRC-TN-59-403.
Order from LC mi$3.00, ph$6.30 PB 145 573

A reformulation and critical discussion of ionospheric cross-modulation shows that the main predictions of the current theory depend on two assumptions: (i) that the effect is small enough to justify a linearized description, and (ii) that certain average properties of the electrons, such as the electron temperature, the (mean) collision frequency and the rate of cooling of the electron gas by collisions between electrons and gas-molecules, are related in a way that does not depend on the modulation frequency.

Microwave Lab., Stanford U., Calif.
THE PROPAGATION OF MICROWAVES THROUGH A MAGNETO-PLASMA, AND A POSSIBLE METHOD FOR DETERMINING THE ELECTRON VELOCITY DISTRIBUTIONS, by A. L. Cullen. Scientific rept. no. 1 on Contract AF 19(604)5226. Oct 59, 20p. 2 refs. M. L. rept. no. 632; AFCRC-TN-59-786.
Order from LC mi$2.40, ph$3.30 PB 145 290

Sagdeyev and Shapranov have shown that the absorption of microwaves in a hot plasma in a steady magnetic field can be calculated in simple closed form with the help of the Boltzmann equation, provided that the effect of collision can be ignored. The present paper is restricted to the special case of propagation of circularly polarized waves parallel to the magnetic field, and the extraordinary ray, in magneto-ionic terminology, is given special attention. It is shown that the formula given by Sagdeyev and Shapranov for this case can be deduced by considering the motions of individual electrons by elementary dynamical methods, using the concepts of Doppler shift and velocity distribution functions to obtain a macroscopic conductivity formula for a high temperature plasma. From this, the absorption is easily calculated.

Rome Air Development Center, Griffiss AFB, N. Y.
A PROPOSED TROPOSPHERIC SCATTER COMMUNICATIONS EQUIPMENT CONFIGURATION FOR TIME DIVERSITY RECEPTION, by C. Frederick Huntington. Dec 59, 24p. 12 refs. RADC-TN-59-304.
Order from LC mi$2.70, ph$4.80 PB 145 600

In this report, an equipment configuration is proposed which enables the use of time diversity with no decrease in channel capacity and no appreciable decrease in transmission speed. Appropriate time delay is introduced at the transmitter terminal to provide signal channels in which the intelligence ... incoherent. Signal channels are separated at the receiver terminal by polarization. The introduction of time delay to the received signal channels provides coherence of intelligence for detection and uncorrelation of fast fade which is necessary for effective combining. The small fraction of signal rotated in plane of polarization in the transmission media is reduced to negligible value by the application of feedback techniques.

Stanford Electronics Lab., Stanford U., Calif.
FADING AND ATTENUATION OF HIGH-FREQUENCY RADIO WAVES OVER A LONG PATH CROSSING THE AURORAL ZONE, by K. C. Yeh. Scientific rept. no. 2 on Contract AF 19(604)1830. 28 July 58, 77p. 39 refs. AFCRC-TN-58-415; AD-152 580.
Order from LC mi$4.50, ph$12.30 PB 145 588

This investigation is concerned with the fading and attenuation of high frequency radio signals propagated over a long path crossing the auroral zone. The fading of high frequency signals propagated over non-auroral paths of comparable length has also been studied, and some new results are presented. The theory of radio wave fading and the methods of analyzing fading records are outlined and discussed. The presence of irregularities in the ionosphere introduces signal amplitude variations which are, in general, functions of time, space coordinates, and the radio frequency. A theory of selective fading is developed in terms of diffraction from an assumed one-dimensional screen of random irregularities.

Stanford Electronics Labs., Stanford U., Calif.
MOTIONS OF LARGE-SCALE TRAVELING DISTURBANCES DETERMINED FROM HIGH-FREQUENCY BACKSCATTER AND VERTICAL INCIDENCE RECORDS, by J. F. Valverde. Scientific rept. no. 1 on Contract AF 19(604)1830. 21 May 58, 100p. 22 refs. AFCRC-TN-58-414; AD-152 579.
Order from LC mi$5.40, ph$15.30 PB 145 587

The existence, in the F region of the ionosphere, of large-scale traveling disturbances has been known for a number of years. A new method of study of these ionospheric anomalies is described in this report, and an analysis is presented of the advantages and limitations of the method. The method is based on back-scatter sounding of the ionosphere. In back-scatter sounding a pulse of radio energy is transmitted from a rotatable directional antenna and strikes the ionosphere at oblique incidence. The radio signal is reflected in a mirror-like manner by the ionosphere and returns to earth at a distant point. Some of the energy striking this point is scattered back towards the transmitter location by irregularities on the earth's surface. This ground-scattered energy can be received as an echo at the transmitter location following an additional reflection by the ionosphere. The range at which the ground scattered echo returns depends on the reflecting ability of the ionosphere at the particular time in the direction towards which the antenna is directed. As the antenna rotates, a Plan Position Indicator (PPI) display of echo range is traced out on an oscilloscope and photographed on 16 mm movie film.

Stanford Electronics Labs., Stanford U., Calif.
REDUCTION AND PROCESSING OF F-LAYER PROPAGATION DATA, by P. M. LaTourvette. Scientific rept. no. 4 on Contract AF 19(604)1830. 15 Dec 58, 72p. 15 refs. AFCRC-TN-59-202.
Order from LC mi$4.50, ph$12.30 PB 145 572

Data from the backscatter records have been compared with the Central Radio Propagation Laboratory frequency predictions for the same period. Information scaled from Stanford's vertical incidence sounder has also been included in the comparisons.

Stanford Electronics Labs., Stanford U., Calif.
TRAVELING-WAVE AMPLIFICATION IN THE IONOSPHERE, by T. F. Bell and R. A. Helliwell. Technical rept. no. 2 on Contract AF 18(603)126. 15 Sep 59, 12p. 1 ref. AFOSR-TN-59-1099.
Order from LC mi$2.40, ph$3.30 PB 145 321

A traveling-wave type of amplification of electromagnetic waves propagating in the "whistler-mode" is presumed to exist in the ionosphere. Streams of electrons moving down the earth's magnetic field lines can enter ionospheric regions in which the stream-velocity spectrum matches approximately the phase velocity of "whistler-mode" waves in that region. Under these conditions amplification of the wave may occur. The present paper deals with the investigation of an analogous, but simplified, situation: a plasma, consisting of a uniform distribution of electrons and positive ions, exists in an extensive zero-temperature region well removed from boundaries.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Army Research Office, Washington, D. C.
PROCEEDINGS OF THE 1959 ARMY SCIENCE CONFERENCE; UNITED STATES MILITARY ACADEMY, WEST POINT, N. Y. 24-26 JUNE 1959. [1959] VOLUME 1. (PRINCIPAL AUTHORS "A" THRU "J"). 406p. 225 refs. AD-220 818.
Order from LC mi$11.10, ph$62.10 PB 145 915-1

The following papers are presented: total water intake using tracer methods; a method for calculating simultaneous homogeneous and heterogeneous equilibria and temperatures of explosion; the number of atoms displaced during heavy particle irradiation of a solid; vigilance, the electroencephalogram and sleep deprivation; a technique for attaining nearly hydrogen-free magnesium samples having certain dimensions; deformation of excavations in the Greenland Ice Cap; radar refraction at low elevation angles; the rotationally symmetric motion of a cylindrical shell due to a constant velocity pressure front; a low altitude FM altimeter; experimental correlation of sintering with several physical properties; growth of single crystals for solid state application; an experimental study of monopulse technique for ground clutter discriminations; a gamma ray pinhole television camera; buckling characteristics of thin cylindrical shells subjected to axial compression and internal pressure; infrared filters of anti-reflected semiconducting materials; a conceptual approach to training research; prophylaxis against acute radiation injury; effects of inter-stimulus interval and aperiodic noise on vigilance behavior; spatial attitude control of Explorer I; the MgO cold cathode; the electrical resistance, and certain magnetic properties, of iron-aluminum alloys; multiple beam antenna system; the production of colored smokes; report of medical experience on acute and repeated exposures in humans with nerve gas (GB) at RMA; nondestructive testing of materials for near-surface defects using delayed ultrasonic pulses; the mechanism of phosphate coating formation; a new wave-guide for millimeter waves; atmospheric propagation errors in guided missile measurement; ionizing radiations in organic synthesis; loop antennas utilizing "mode suppression and selection"; some studies of the jet compressor; a new mechanical resuscitator for military field use; comparison of ballistic data to electrolyte changes in wounded muscle; microwave techniques in measurement of lifetime in germanium; information transfer in image intensifier systems; syntheses of rubber copolymers by some new methods

Army Research Office, Washington, D. C.
PROCEEDINGS OF THE 1959 ARMY SCIENCE CONFERENCE; UNITED STATES MILITARY ACADEMY, WEST POINT, N. Y. 24-26 JUNE 1959. [1959] VOLUME 2. (PRINCIPAL AUTHORS "K" THRU "Z"). 447p. 225 refs. AD-227 332.
Order from LC mi$11.10, ph$68.10 PB 145 915-2

The following papers are presented: prevention of spontaneous detonation of beta lead azide during crystallization; survival of grid-shielded X-irradiated mice; chemical dosimetry; investigations on the detection of subsoil objects; high-temperature semiconducting materials: boron and aluminum borides; nondestructive testing of cast and sintered components; studies on a biochemical system for the detection of anticholinesterase agents; secondary-electron mixed-radiation dosimeters (SEMIRAD); deep core drilling in glaciers; injury, would healing, and liver regeneration; ultrasonic determination of elastic constants of metals at elevated temperatures; Signal Corps R and D on automatic programming of digital computers; preparation, properties, and applications of reflecting coatings for the vacuum ultraviolet; human lethal dose in biological warfare defense; criterion equivalence technique for test selection to predict performance on undeveloped weapons; frequency-modulated acoustic flowmeter; magneto diffusion effects in germanium; air permeable textiles resistant to wetting by liquid rocket fuels; generalized behavior of toxic clouds in the atmosphere; determination of satellite spatial orientation using Explorer IV as an example; formation of photoptic images in industrial fluoroscopy; a reciprocal phase modulator for rapid-scanning microwave antennas; modified Stodola method including rotary inertia and shear flexibility; contributions of psychiatry; ionized gasses in the presence of rotating electric fields; a variable sensitivity gas thermometer for use at low temperatures; effect of a magnetic field on transfer characteristics of particles in an electric arc; polar hypotheses; protective effect of natural food materials against whole-body irradiation; numerical analysis in aerial delivery; the quasi-parallel light principle; hollow-conical or flat radiation or detection patterns; deductions from the thermodynamics of the transition metals and alloys; experiments in combat operations; new dialysis technics in treatment of acute kidney failure; the interaction of technology, field experiments and operational planning. (See also PB 145 915-1)

Arnold Engineering Development Center [Tullahoma Tenn.]
REPORT WRITING GUIDE FOR ARNOLD ENGINEERING DEVELOPMENT CENTER (REVISED EDITION) by C. B. Kestler. Rept. on ARO, Inc., Contract AF 40(600)700. May 58, 59p. 36 refs. AEDC-TN-58-28; AD-157 134.
Order from LC mi$3.60, ph$9.30 PB 146 056

This report consists of an A-W encyclopedia followed by a bibliography and two appendixes. In the A-W arrangement, there are short articles on the more detailed subjects pertaining to the production of AEDC reports. The headings for these main entries are capitalized in the index. Basic questions of AEDC report procedures, practices, techniques, and available services are answered in the brief entries scattered throughout in the appropriate alphabetical spot. This material has been arranged and indexed to facilitate the reader's finding the answers to specific questions and to insure that no essential details pertaining to the production of AEDC reports have been overlooked.

Avco-[Everett] Research Lab. [Mass.]
ON THE EFFECT OF ATTENUATION ON GAS DYNAMIC MEASUREMENTS MADE IN SHOCK TUBES, by P. H. Rose and W. Nelson. Rept. on Contract AF 04(645)18. Apr 58, 43p. 27 refs. Research rept. 24; AD-212 016.
Order from LC mi$3.30, ph$7.80 PB 146 206

The attenuation of the shock strength of strong shock waves produced in air in high pressure shock tubes is considered. Data on the attenuation experienced in several sizes of shock tubes over a large range of conditions are presented. Experiments are performed to measure the critical flow quantities directly to establish the trends and limits of the changes in the properties of the shock compressed air. The results are analyzed and the effect on some of the gas dynamic measurements are estimated.

Massachusetts Inst. of Tech., Cambridge.
A CLASS OF QUEUEING PROBLEMS, by Hirsh Newton Garber. Doctoral thesis. Interim technical rept. no. 13 on Fundamental Investigations in Methods of Operations Research, Contract DA 19-020-ORD-2684. Oct 59, 131p. 23 refs. OOR rept. 968.28-M.
Order from LC mi$6.90, ph$21.30 PB 145 177

A situation which gives rise to a queueing (waiting line) problem is one in which units (or "customers") arrive at a facility desiring some type of service which that facility offers, and where units will wait for service if, on arrival, the facility cannot offer immediate service due to the presence of other units being served. If the exact arrival time of all units and the exact servicing time of each unit is known, no real problem arises since the behavior of the system is completely specified. Thus, only when one or both of these quantities is statistical in nature does the problem become interesting. The statistical distribution of arrival times and of servicing times will thus be two conditions by which classification of queueing problems can be made.

Princeton U., N. J.
STOCHASTIC PROPERTIES OF ELEMENTARY LOGISTIC COMPONENTS, by Harlan D. Mills. Research Memo. no. 9 on Econometric Research Program, Contract Nonr-1858(16). 27 Feb 59, 14p. 15 refs. AD-226 009.
Order from LC mi$2.40, ph$3.30 PB 145 593

Princeton U., N. J.
STRUCTURES IN LOGISTICS OPERATIONS, by Harlan D. Mills. Research memo. no. 8 on Econometric Research Program, Contract Nonr-1858(16). 27 Feb 59, 28p. 7 refs. AD-226 132.
Order from LC mi$2.70, ph$4.80 PB 145 592

Rome Air Development Center, Griffiss AFB, N. Y.
RADC TECHNICAL REVIEW. Dec 58, 59p. RADC-TN-58-310; AD-148 980.
Order from LC mi$3.60, ph$9.30 PB 145 493

Contents:
Nuclear magnetic resonance studies
Point-to-point communication using the moon as a passive reflector
Information processing
New discoveries in propagation with associated aspects of modulation and detection techniques
Electromagnetic interference
Space vehicle communications and ranging systems

Communication Theory

Baird-Atomic, Inc., Cambridge, Mass.
OPTICAL FILTER TEXT READER STUDY, by John A. Fitzmaurice, Edward N. Sabbagh, and William G. Elliott. Rept. on Contract AF 30(602)1828. 20 Aug 59, 41p. 11 refs. B-A Document no. 3055; RADC-TR-59-95; AD-217 675.
Order from LC mi$3.30, ph$7.80 PB 145 529

The use of aperture-stops to perform general two-dimensional, linear, filtering operations is described. This theory has been applied to the problem of building an automatic print reader. A breadboard model was built and used to demonstrate the feasibility of this method of print reading. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
WORD CORRELATION STUDY, by R. P. Mitchell and E. Greer. Rept. on Contract AF 30(602)1889. [1959] 15p. 4 refs. RADC-TN-59-6; AD-208 288.
Order from LC mi$2.40, ph$3.30 PB 145 528

A discussion is presented of word correlation with respect to the syntax of English. Word correlation is feasible if a normalized English language is formulated in terms of which all other words are syntactically defined. Correlation factors are computed by counting primitive words occurring in certain syntactic reduction strings. A method is indicated for correlating sentences. Adaptations of this method to less sophisticated systems are discussed. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A HIGH SPEED ROTATING MIRROR CAMERA, by B. Leo DeMaré, H. G. McGuire and E. L. Bonhage. Feb 59, 29p. 2 refs. Rept. no. 1069.
Order from LC mi$2.70, ph$4.80 PB 145 699

This camera was designed for recording projectile velocity data from a microwave interferometer, presented by a cathode ray oscilloscope. A mirror, consisting of a block of stainless steel with 4 faces, each 3 inches in width, is rotated at a speed of 10,000 rpm. Light from the lens is swept over a length of 70 mm film mounted, emulsion side down, on a stationary transparent drum 36 inches in diameter. A mechanism is provided for transporting the film onto the drum from a magazine and returning it after exposure. The camera has a linear writing speed of 39 in/ms at CRT spot frequencies up to 500 KC, on Kodak Tri-X pan film. (Author)

Institute of Optics, U. of Rochester, N. Y.
LENS DESIGN FOR THE MINICARD CAMERA, by Robert E. Hopkins and Robert R. Shannon. Final rept. on Contract AF 30(635)2870. 1 July 57, 28p. RADC-TR-57-160; AD-131 298.
Order from LC mi$2.70, ph$4.80 PB 145 546

The Minicard process would be used to reduce aerial photographs with limiting resolutions of around 40 lines/mm, a lens would therefore have to be capable of resolving around 764 lines/mm. Two types of lenses were completely designed. These were a curved field design and an inverted telephoto design. A sample of the latter design tested photographically showed that this type of lens may suffice for some of the proposed applications.

SOCIAL SCIENCES

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A DYNAMIC THEORY OF CONSUMER'S CHOICE, by Herbert Scarf. Technical rept. no. 10 on Contract Nonr-225(28). 25 Mar 59, 39p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 145 210

A theory of consumer's choice is discussed which is based on the idea of utility maximization, subject to constraints in expenditures. A description is given of those utility functions for which future tastes are independent of past consumption, and an even smaller class is described for which tastes are stationary in time. It is shown that the utility function will have these properties only if it is a discounted sum of functions pertaining to consumption in the separate periods. The discount factor leads to the notion of a personal interest rate, which may be constant, or a function of the consumption level. The question of whether a decreasing ratio of expenditure to total wealth is compatible with such a utility function is discussed. The case of constant personal interest is examined in detail and it is shown that no stationary utility function permits a decreasing ratio of expenditure to wealth for a sufficiently wide range of market interest rates. On the other hand, an example is given of a utility indicator with a variable personal interest rate, which predicts a decreasing ratio of expenditure to wealth for all market interest rates. (Author)

Documentation, Inc. [Washington, D. C.]
AN EXTERNAL INDEX TO A COMPUTER STORE OF ITEMS AND TRANSACTIONS AS ILLUSTRATED BY PROJECT ECHO, by Mortimer Taube. Rept. on Contract AF 49(638)91. Dec 59, 20p. AFOSR-TN-60-8.
Order from LC mi$2.40, ph$3.30 PB 145 509

This paper describes a combined data processing and information retrieval system designed to handle a changing store of information concerning a research and development contract program. The system was designed for the contract program operated by the Air Force Office of Scientific Research but the concepts used in the design were generalized and made applicable to any information problem involving the storage and retrieval of changing sets of information. The concepts used in this analysis are the item, the transaction, and the index. After describing how the system operates with reference to AFOSR research and development contracts, the paper illustrates the operation of a similar system for the Cancer Chemotherapy National Service Center of the National Institutes of Health. In conclusion, the paper presents certain general conclusions relating to the man-machine problem of entering information, maintaining information, modifying information and, finally, removing information from a store.

George Washington U., Washington, D. C.
STRUCTURE AND CLASSIFICATION IN RESOURCE FLOW MODELS, by Stedman B. Noble. Rept. on Logistics Research Project, Contract Nonr-761(05). 19 May 59, 37p. 22 refs. Serial T-100/59.
Order from LC mi$3.00, ph$6.30 PB 145 453

This paper is a study of the structure, both empirical and theoretical, of resource flow models. It defines the kinds of structure that can exist in a model of the economy; it shows how to determine this structure, and describes the structure of several existing models Finally, there is a discussion of the relevance of structure for the uses of models, including the implication for the classification problem of resource flow models. The term "resource flow models", used in the title, requires some explanation. As a model, the most developed analysis of resource flows is the interindustry model also called the input-output model, which makes use of a mathematical matrix.

Minnesota U. School of Business Administration, Minneapolis.
AN IMPORT-EXPORT MODEL, by Richard Savage. Technical rept. no. 4 on Contract Nonr-2582(00). 1 Feb 59, 34p.
Order from LC mi$3.00, ph$6.30 PB 145 253

For a given year and group of countries, the import-export data can be arranged like a contingency table, except the diagonal cells are zero and the other entries are quantities of money, a continuous variable instead of a discrete variable. A model describing the data and techniques for the statistical analysis are presented. This is a "null model" in the sense that the departures from it are of primary interest. The North Atlantic Area (1928) is used as an illustration. (Author)

Stanford U., Calif.
IMPERFECT COMPETITION AND GENERAL EQUILIBRIUM: EXISTENCE AND STABILITY, by Takashi Negishi. Technical rept. no. 68 on Contract N6onr-25133. 4 Feb 59, 13p. 11 refs; AD-211 794.
Order from LC mi$2.40, ph$3.30 PB 145 582

Stanford U., Calif.
IMPUTATIONS, EQUILIBRIUM, AND PROGRAMMING, by Hirofumi Uzawa. Technical rept. no. 73 on Contract N6onr-25133. 24 Mar 59, 34p. 30 refs.
Order from LC mi$3.00, ph$6.30 PB 145 251

The relationship between the optimum allocation and imputed prices of the factors of production in general mathematical programming is investigated. A model of competitive equilibrium is constructed in which quasi-equilibrium prices are precisely the ones imputed by Wieser's principle of the "productive contribution." In later sections, Walras' simultaneous and successive tâtonnement processes are applied to solve mathematical programming problems.

Stanford U., Calif.
WALRAS' TÂTONNEMENT AND THE EXISTENCE OF AN EQUILIBRIUM FOR A COMPETITIVE ECONOMY, by Hirofumi Uzawa. Technical rept. no. 70 on Contract N6onr-251(33). 20 Mar 59, 24p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 145 387

The present note is concerned with the process of tâtonnement introduced by Walras and a proof is given of the existence theorem based on the process of tâtonnement. The existence theorem in the present note is slightly more restricted than the existence theorems in Arrow and Debreu. (See also PB 145 386)

Stanford U., Calif.
WALRAS' TÂTONNEMENT IN THE THEORY OF EXCHANGE, by Hirofumi Uzawa. Technical rept. no. 69 on Contract N6onr-251(33). 11 Mar 59, 28p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 145 386

The theory of tâtonnement by the aid of which Leon Walras developed his theory of general equilibrium seems one of the most valuable techniques in economic analysis. There have been many contributions to the Walrasian theory of tâtonnement. There are, however, important problems in that theory which have not yet been satisfactorily solved. The present article is concerned with tâtonnement processes in the competitive exchange economy, and some of the gaps in that theory are filled, especially with respect to the stability problem. (See also PB 144 672)

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Apr 60.
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Application of light scattering to crystal perfection, by W. H. Vaughan, F. W. VonBatchelder, and J. W. Davisson
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Applications Research: Mathematical model for evaluating tactical decisions in fleet air-defense games
Chemistry: Wetting properties of tetrafluorethylene and hexafluoropropylene copolymers. Acoustical spectrum as a tool for investigating the impact sensitivity of explosives. Modification of the NRL colorimetric method for the determination of bis-2(chloroethyl)sulfide with DB-3
Mechanics: Experimental measurement of mechanical impedance
Metallurgy and Ceramics: Experimental casting of columbium from a "skull" furnace. Phase diagram for the columbium-zinc system. Effects of environment on the creep-rupture properties of nickel and nickel-base alloys. Neutron flux measurements for materials irradiation experiments in nuclear research reactors at ANL, BNL, ORNL, and NRTS
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General

Liquid metal fuel reactor experiment, zirconium nitride film theory. The Babcock and Wilcox Company, Atomic Energy Division, Feb 60. Contract AT(30-1)-1940. 34p. Order from OTS. $1.00. BAW-1087

Liquid metal fuel reactor experiment, investigation of precleaning and decontamination methods, by W. S. Leedy. The Babcock and Wilcox Company, Atomic Energy Division, Feb 60. Contract AT(30-1)-1940. 32p. Order from OTS. $1.00. BAW-1094

Liquid metal reactor experiment, quarterly technical report. The Babcock and Wilcox Company, Atomic Energy Division, Apr-Jun 59. Contract AT(30-1)-1940. 60p. Order from OTS $1.50. BAW-1170

Biology and Medicine

Radiation measurements and the spectrum, by Marshall Brucer and Yoichiro Umegaki. Oak Ridge Institute of Nuclear Studies, Inc. Oak Ridge, Tennessee, Aug 59. 29p. Order from OTS. $1.00. ORINS-32

Biology and medicine semiannual report University of California, Lawrence Radiation Laboratory, Berkeley, California, Apr-Sep 59. Contract W-7405-eng-48. 92p. Order from OTS. $2.25. UCRL-8998

The effect of exogenous calcium and ℓ-thyroxine on parturition in the radioiodine-thyroidectomized rat, by Marshall Ward Parrott. University of California, Lawrence Radiation Laboratory, Berkeley, California. Dec 59. Contract W-7405-eng-48. 38p. Order from OTS. $1.25. UCRL-9004

Chemistry—General

Chemical behavior of uranium and thorium in fused salts, by Derek L. Hill and Robert A. Osteryoung. Brookhaven National Laboratory, Associated Universities, Inc. Sep 59. Contract AT 30-2-GEN-16. 9p. Order from OTS. $.50. BNL 588(T-166)

Behavior of a bioling metal thermosiphon loop, by G. Jansen, Jr. Hanford Atomic Products Operation, General Electric, Richland, Washington. Dec 59. Contract AT(45-1)-1350. 38p. Order from OTS. $1.25. HW-63052

Calculation of the composition of reactor-irradiated heavy nuclides, by R. P. Schuman and R. L. Tromp. Phillips Petroleum Co. Idaho Operations Office. Dec 59. Contract AT (10-)-25. 80p. Order from OTS. $1.00. IDO-16571

Chemistry semi-annual summary research report, by Ames Laboratory Staff. Ames Laboratory Research and Development Report, U.S.A.E.C. Jan-Jun 59. Contract W-7405-eng-82. 74p. Order from OTS. $2.00. IS-15

An incinerator for recovery of enriched uranium from graphite powder, by A. C. Dumrose. University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. Mar 60 Contract W-7405-eng. 36. 28p. Order from OTS. $1.00. LA-2372

Infrared specta of biphenyl and several deuterated biphenyls, by J. M. Scarborough. Atomics International, Canoga Park, California. Mar 60. Contract AT(11-1)-GEN-8. 16p. Order from OTS. $.50. NAA-SR-4657

Investigation of tetralin explosion, by J. S. McDonald and J. E. Owens. Atomics International, Canoga Park, Calif. Mar 60. Contract AT(11-1)-GEN-8. 58p. Order from OTS. $1.75. NAA-SR-4803

The radiochemistry of arsenic, by Harold C. Beard. Florida State University, Tallahassee, Florida. Jan 60. 27p. Order from OTS. $.50. NAS-NS-3002

The radiochemistry of francium, by Earl K. Hyde University of California, Lawrence Radiation Laboratory, Berkeley, California. Jan 60. 34p. Order from OTS. $.50. NAS-NS-3003

HASL manual of standard procedures with revisions and modifications to August 1959, by Ira B. Whitney, Editor. New York Operations Office, Health and Safety Laboratory, Analytical Division. Feb 60. 170p. Order from OTS. $1.75. NYO-4700

Ultraviolet spectrophotometric determination of uranium, by Arno H. A. Heyn and Gurupada Banerjee. Boston University, Boston, Massachusetts. Nov 59. Contract AT(30-1) 1873. 25p. Order from OTS. $.75. NYO-7568

Fused salt heat transfer- Part III: Forced-convection heat transfer in circular tubes containing the salt mixture $NaNO_2$-$NaNO_3$-KNO_3, by H. W. Hoffman and S. I. Cohen. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 26p. Order from OTS. $1.00. ORNL-2433

Purification of Pm^{147} from fission-produced rare earths, by R. S. Pressly. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 11p. Order from OTS. $.50. ORNL-2843

Solids separation by a hydraulic cyclone with a batch underflow receiver, by P. A. Haas. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 47p. Order from OTS. $1.50. ORNL-2876

Nonnuclear uses for depleted uranium, by J. C. Bressee and others. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 78p. Order from OTS. $2.25. ORNL-2889

Catalyzed Hyrolysis of pyrophosphate by thorium oxide, by C. M. Boyd and others. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 14p. Order from OTS. $.50. ORNL-2893

Nuclear-magnetic-resonance studies of hydrogen bonding, by Jefferson Clark Davis, Jr. (thesis) University of California, Lawrence Radiation Laboratory, Berkeley, California. Oct 59. Contract W-7405-eng-48. 76p. Order from OTS. $2.00 UCRL-8909

Nuclear quadrupole resonance of some inorganic chlorine compounds, by Allan Harvey Reddoch (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. 175p. Order from OTS. $3.00. UCRL-8972

Downflow boiling and nonboiling heat transfer in a uniformly heated tube, by Robert LeRoy Sani (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Jan 60. Contract W-7405-eng-48. 88p. Order from OTS. $2.50. UCRL-9023

Chemical properties of astatine, by Evan H. Appelman (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Jan 60. Contract W-7405-eng-48. 113p. Order from OTS. $2.50. UCRL-9025

Bio-organic chemistry, quarterly report, September, October, November 1959. Univ. of Calif. Lawrence Radiation Lab., Berkeley, Calif. Dec 59. Contract W-7405-eng-48. 61p. Order from OTS. $1.75. UCRL-9041

Chemistry—Radiation and Radiochemistry

The determination of zirconium-95 plus niobium-95 by anion exchange separation from other fission products, by A. C. Leaf Hanford Atomic Products, General Electric, Richland, Washington. Oct 59. Contract AT(45-1)-1350. 20p. Order from OTS. $.75. HW-62188

Chemistry—Separation Processes for Plutonium and Uranium

Dissolution of irradiated Consolidated Edison power-reactor fuel by the sulfex and darex processes, by Robert A. Ewing and others. Battelle Memorial Institute, Columbus, Ohio. Mar 60. Contract W-7405-eng-92. 22p. Order from OTS. $.75. BMI-1427

An improved acid saturation method for the determination of tri-n-butyl phosphate, by W. E. Shuler. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Aiken, South Car.

Dec 59. Contract AT(07-2)-1. 9p. Order from OTS. $.50. DP-449

Decladding of Consolidated Edison power reactor fuel by sulfex and darex processes: cyclic dissolution experiments, by L. M. Ferris. Oak Ridge National National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 13p. Order from OTS. $.50. ORNL-2822

Modified zirflex process for dissolution of 1-10% U-Zr alloy fuels in aqueous NH_4F-NH_4NO_3-H_2O_2: laboratory development, by T. A. Gens. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 24p. Order from OTS. $.75. ORNL-2905

Controlled Thermonuclear Processes

Zeus control system, by A. E. Binder, 1313. Scandia Corporation. Feb 60. 21p. Order from OTS. $.75. SCTM 44-60(12)

Energy loss of fast ions to a sea of constant temperature electrons, by Francis C. Gilbert. University of California, Lawrence Radiation Laboratory, Livermore Site, Livermore, California. Nov 59. Contract W-7405-eng-48. 8p. Order from OTS. $.50. UCRL-5697

Controlled thermonuclear research quarterly report June, July, August 1959. University of California, Lawrence Radiation Laboratory, Livermore and Berkeley, California. Sep 59. Contract W-7405-eng-48. 143p. Order from OTS. $2.75. UCRL-8887

Photoprotons produced by 245±15-mev gamma rays on carbon, by Robert J. Cence (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. Contract W-7405-eng-48. 52p. Order from OTS. $1.50. UCRL-8921

The elastic scattering of 5-bev π^- mesons on hydrogen, by Richard Garland Thomas, Jr. (thesis) University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. Contract W-7405-eng-48. 63p. Order from OTS. $1.75. UCRL-8965

5-bev neutron cross sections in hydrogen and other elements, by John H. Atkinson (thesis) University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. Contract W-7405-eng-48. 80p. Order from OTS. $2.25. UCRL-8966

Polarization of bremsstrahlen, by John M. Dudley (thesis) University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. Contract W-7405-eng-48. 49p. Order from OTS $1.50. UCRL-8980

Physics division semiannual report May through October 1959. University of California, Lawrence Radiation Laboratory, Berkeley, California. Dec 59. Contract W-7405-eng-48. 54p. Order from OTS. $1.75. UCRL-9017

Controlled thermonuclear research quarterly report September, October, November 1959. University of California, Lawrence Radiation Laboratory, Berkeley, California. Dec 59. Contract W-7405-eng-48. 148p. Order from OTS. $3.00. UCRL-9002

Criticality Studies

Multi-region reactor lattice studies, quarterly progress report for the period October 1, to December 31, 1959, by Ira H. Coen. Westinghouse Electric Corporation, Atomic Power Department, Pittsburgh, Pennsylvania. Jan 60. Contract AT(30-1)-2176. 13p. Order from OTS. WCAP-1408

Engineering and Equipment

Toroid rotator for small-scale dynamic corrosion studies-design, fabrication, and operation, by R. M. Warner and others. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 24p. Order from OTS. $1.00. ORNL-2870

Stability of externally pressurized gas journal bearings. Interim Report. Iazar Licht. Sponsored by Dept. of Defense; AEC; and Maritime Administration under Contract Nonr-2342(00), (I-A2049-8). Oct 59. 36p. Mi. $3.00 Ph. $6.30 Order from LC. AECU-4484

Behavior of rubbing molybdenum surfaces in sodium environments, by J. W. Kissel and others. Battelle Memorial Institute, Columbus, Ohio. Jan 60. Contract W-7405-eng-92. 23p. Order from OTS. $1.00. BMI-1405

Examination of a nonregenerative heat exchanger from the U. S. S. Nautilus (SSN-571), by Warren E. Berry and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract NObs-67500. 54p. Order from OTS. $1.75. BMI-1416

Brief review of heat transfer problems encountered in the production of magnetic fields, by L. G. Alexander. Oak Ridge National Laboratory, Oak Ridge, Tennessee. May 59. Mi. $2.40 Ph. $3.30. 11p. Order from LC. CF-59-5-87

An autographic elevated temperature creep testing facility, by Robert L. Hammel and Robert E. Uhrig. Ames Laboratory, Research and Development Report U.S.A.E.C. Iowa State University. Nov 59. Contract W-7405-eng-82. 23p. Order from OTS. $.75. IS-66

Geology and Mineralogy

Fatigue damage in materials employed in pressure equipment, Progress Report no. 3 for July 1, 1959 through October 31, 1959. by, L. U. Rastelli. Nov 59. Contract AT(30-1)-2146. 77p. Order from LC. Mi. $4.50 Ph. $12.30. NYO-2328

Underground exploration of the quartzite cap claims, Yellow Jacket area, Marysvale, Utah, by Stephen R. Steinhauser and Bert L. Myerson. Salt Lake Branch Office, AEC, Grand Junction Operations Office, Salt Lake City, Utah. Aug 55. 10p. Order from OTS. $.50. RME-2038

Final report for June 1949 to the end of contract, June 30, 1958, by John W. Gruner. University of Minnesota, Minneapolis, Minnesota. May 59. Contract AT(30-1-610). 39p. Order from OTS. $1.25. RME-3159

Health and Safety

Natural aerosols and nuclear debris studies, progress report no. 1. GRD research notes no. 8., by P. J. Drevinsky and others. Air Force Cambridge Research Center. Geophysics Research Directorate, Mass. Sep 58. Contract AT(49-7)-1431. 49p. Order from LC. Mi. $3.30 Ph. $7.80. AFCRC-TN-58-652

Monitoring for air-borne radioactive materials at Hanford Atomic Products Operation, by J. K. Soldat. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Jun 59. 20p. Order from LC. Mi. $2.40 Ph. $3.30. HW-SA-38

Fission product release by the high temperature uranium-steam reaction, by A. J. Scott. General Electric, Hanford Atomic Products Operation, Richland, Washington. Nov 59. Contract AT(45-1)-1350. 42p. Order from OTS. $1.25. HW-62604

Quarterly progress report, research and development activities in the field of radiological sciences, July-September, 1959. Hanford Atomic Products Operation, Richland, Washington. Nov 59. Contract AT(45-1)-1350. 42p. Order from OTS. $1.25. HW-62638

Nuclear incident at the Idaho chemical processing plant, by William L. Ginkel and others. Phillips Petroleum Company, Idaho Operations Office, Idaho Falls, Idaho. Oct 59. 100p. Order from OTS. $2.25. IDO-10035

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Distribution of nuclear fallout, annual report [for] period October 1, 1958-September 30, 1959. Columbia University, Palisades, N. Y. Lamont Geological Observatory. Oct 59. Contract AT(30-1)-1656. 170p. Order from LC. Mi. $8.10 Ph. $27.30 NYO-2841

Fate of radioactive contaminants in water, progress report no. 1. (for the period Apr 7, 1957 to May 1, 1958). U. S. Dept. of Health, Education, and Welfare. Robert A. Taft Sanitary Engineering Center. Cincinnati, Ohio. 1959. Contract AT(49-5)-1288. 56 p. Order from LC. Mi. $3.60 Ph. $9.30 R59-2

Automatic reader for air-monitoring filter paper, by M. D. Thaxter and Thomas Taussig. University of California, Lawrence Radiation Laboratory, Berkeley, California. Sep 59. Contract W-7405-eng-48. 14p. Order from OTS. $.50. UCRL-8701

Petrographic studies of fallout material from the surface and undergroung shots, by Irvin C. Brown and Lyle T. Alexander. Bureau of Plant Industry, Soils, and Agricultural Engineering. May 53 decl Dec 54. Order from LC. Mi. $3.90 Ph. $10.80. WT-423

Radiological safety, by Tom D. Collison. Armed Forces Special Weapons Project. Field Command, Albuquerque, N. Mex. May 55. 175p. Order from LC. Mi. $8.40 Ph. $28.80 WT-1166(Del.)

Radiological safety, by Gordon L. Jacks and George C. Zimmerman. Los Alamos Scientific Lab., N. Mex. Nov 58. 48p. Order from LC. Mi. $3.30 Ph. $7.80 WT-1685

Instruments

Response of pressure gauges to dust-laden shock waves, by J. R. Banister and C. D. Broyles. Sandia Corp., Albuquerque, N. Mex. [nd] Decl. Feb 59. Contract W-7405-eng-36. 10p. Order from LC. Mi. $1.80 Ph. $1.80. AECD-4290

A high current switch of low inductance, by C. D. Nail. University of California, Livermore Radiation Laboratory. Mar 59. Contract (LE-306-1). 5p. Order from LC. Mi. $1.80 Ph. $1.80 AECU-4308

Switching circuitry for high-intensity, intensity pulsed magnetic field apparatus, by Y. B. Kim and E. D. Platner. University of Washington, Seattle, Washington. Jun 59. Contract Nonr 477(12). 21p. Order from LC. Mi. $2.70 Ph. $4.80 AECU-4310

Design of the core storage unit, report no. 91, by S. R. Ray. University of Illinois., Urbana. Digital Computer Laboratory. Aug 59. Contract AT(11-1)-415. 33p. Order from LC. Mi. $3.00 Ph. $6.30. AECU-4315

A feasibility study of optically regenerative light intensifier. Final report for period July to December 1958 and Extension Period January to February 1959. ITT Labs. Div. of International Telephone and Telegraph Corp., Fort Wayne. [nd] Contract AT(11-1)-648. 23p. Order from LC. Mi. $2.70 Ph. $4.80. AECU-4349

Backscatter gaging device, mid-term status report, by B. C. Rusche. Lockheed Nuclear Products, Marietta, Georgia. Nov 59. Contract AT(30-1) 2428. 20p. Order from LC. Mi. $2.40 Ph. $3.30 AECU-4454

Research and investigation leading to methods of generating and detecting radiation in the 100 to 1000 micron wavelength range of the spectrum. Quarterly Progress Report no. 14 [for] June 1, 1959 to September 1, 1959, by P. D. Coleman and others. University of Illinois, Urbana. Engineering Experiment Station. Oct 59. Contract AT(11-1)-392. 78p. Order from LC. Mi. $4.50 Ph. $12.30 AECU-4458

On the dynamic design of non-regenerative transistor circuits, rpt. no. 94, by Toshiro Kunihiro University of Illinois, Urbana. Digital Computer Laboratory. Nov 59. Contract AT(11-1)-415. 41p. Order from LC. Mi. $3.30 Ph. $7.80. AECU-4505

Transistor scintillation spectrometer, by Michael G. Strauss. Argonne National Laboratory, Lemont, Illinois. Feb 60. Contract W-31-109-eng-38. 28p. Order from OTS. $1.00. ANL-6123

Magnetic recorder for nuclear pulse application, period covered: June 5, 1959 to August 5, 1959, by G. M. Burgwald. Illinois Inst. of Tech., Chicago. Armour Research Foundation. Aug 59. Contract AT(11-1)-702. 8p. Order from LC. Mi. $1.80 Ph. $1.80 ARF-1151-1

Magnetic recorder for nuclear pulse application, covering periods: August 6, 1959 to October 5, 1959, by G. M. Burgwald and C. A. Stone. Illinois Inst. of Tech., Chicago. Armour Research Foundation. [nd] Contract AT(11-1)-702. 27p. Order from LC. Mi. $2.70 Ph. $4.80. ARF-1151-2

An improved nuclear density gauge, period covered: October 2 to November 1, 1959, by G. M. Burgwald. Illinois Inst. of Tech., Chicago. Armour Research Foundation. [nd] Contract AT(11-1)-745. 3p. Order from LC. Mi. $1.80 Ph. $1.80. ARF-1152-5

Test results and design comparisons for liquid metal-to-air radiators, by H. J. Stumpf and others. Oak Ridge National Lab., Tenn. Jul 54 Decl. Oct 59. Contract W-7405-eng-26. 84p. Order from LC. Mi. $4.80 Ph. $13.80 CF-54-7-187

Calibration of the revalet, a remotely variable lead-transmission gamma-ray dosimeter, by D. L. Gilliland. Oak Ridge National Lab., Tenn. [1955]. Decl. with deletions Feb 57. Contract W-7405-eng-26. 14p. Order from LC. Mi. $2.40 Ph. $3.30. CF-55-2-111(Del.)

A 2000 channel analyzer for neutron spectroscopy, by J. Hahn, and W. W. Havens, Jr. Pupin Cyclotron Laboratory, Columbia University

New York, New York and George B. Pegram Laboratory, Columbia University, New York, New York. Nov 59. Contract AT(30-1)-GEN-72. 41p. Order from OTS. $1.25. CU-198

A remotely controlled metallograph-II, by W. H. Leith. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Aiken, South Carolina. Dec 59. Contract AT(07-2)-1. 15p. Order from OTS. $.50. DP-450

Remote area scintillation monitoring system, by W. G. Spear. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Apr 59. 15p. Order from LC. Mi. $2.40 Ph. $3.30. HW-59834

ETR nuclear instrumentation final report, by D. C. Hanson. Phillips Petroleum Co. Idaho Operations Office. Feb 60. Contract AT(10-1)-205). 28p. Order from OTS. $1.00. IDO-16566

Self-balancing resistivity measuring set, by T. J. Boland. Phillips Petroleum Co. Idaho Operations Office. Feb 60. Contract AT(10-1)-205. 24p. Order from OTS. $.75. IDO-16573

A remotely operable controlled radius bend fatigue apparatus, by G. L. Cutler. Knolls Atomic Power Lab., Schenectady, N. Y. Oct 59. Contract W-31-109-Eng-52. 11p. Order from LC. Mi. $2.40 Ph. $3.30 KAPL-M-GLC-4

Liquid scintillator radiation rate meters for the measurement of gamma and fast neutron rates in mixed radiation fields, by D. L. Williams and F. N. Hayes. University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. Mar 60. Contract W-7405-ENG. 36 59p. Order from OTS $1.75. LA-2375

Preliminary investigation of a five-crystal scintillation gamma-ray spectrometer, by Roger E. Mills and Robert M. Kloepper. Los Alamos Scientific Lab., N. Mex. Sep 58. Contract W-7405-eng-36. 35p. Order from LC. Mi. $3.00 Ph. $6.30 LAMS-2257

A rotary vacuum seal, by Richard W. Roberts. Brown University, Providence. Jan 59. Contract AT(30-1)-2101. 4p. Order from LC. Mi. $1.80 Ph. $1.80 M-6845

Time base generator for OMR critical experiment, by L. S. Beller. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Oct 58. 8p. Order from LC. Mi. $1.80 Ph. $1.80 NAA-SR-MEMO-3138

Scintillation detector and preamplifier unit for general counting room use, A.I. critical experiment laboratory. by L. S. Beller. Atomics International Div. North American Aviation, Inc., Canoga Park, Calif. Dec 58. 7p. Order from LC. Mi. $1.80 Ph. $1.80 NAA-SR-MEMO-3308

Method for determination of liquid density and viscosity of organic coolants over the temperature range (m. p. to 850°F), by G. Asanovich Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. May 59. 12p. Order from LC. Mi. $2.40 Ph. $3.30 NAA-SR-MEMO-3863

Photo electric micro-micro amphere current source, by S. G. Barnes. Atomics International Div., North American Aviation, Inc., Canoga Park, California. Jul 59. 10p. Order from LC. Mi. $2.40 Ph. $3.30 NAA-SR-MEMO-4159

The development of a beta-ray particle size analyzer, quarterly technical status report[for] July 16-October 15, 1959. [nd] Contract AT(30-1)-2372. 11p. Order from LC. Mi. $2.40 Ph. $3.30 NYO-2654

Development of an instrument and technique utilizing carbon-14 for measuring very low concentrations of oxygen in high purity metals, quarterly status report no. 3 [for] period August 1, 1959 through October 31, 1959, by Roger A. Covert. Alloy Research Corp., Watertown, Mass. Nov 59. Contr AT(30-1)-2335. 8p. Order from LC. Mi. $1.80 Ph. $1.80. NYO-8911

Development of high speed electron accelerator structures, interim report no. 9, by J. A. Baicker and others. David Sarnoff Research Center, Princeton, N. J. Oct 59. Contract AT (30-1)-1958. 16p. Order from LC. Mi. $2.40 Ph. $3.30. RIB-42

Project DeHenry, the study of a new type of explosive-to-electric transducer, by G. W. Anderson and S. E. Whitcomb. Sandia Corp., Albuquerque, N. Mex. Jul 58. Contract AT(29-1)-789. 109p. Order from LC. Mi. $6.90. Ph. $21.30 SCTM-150-58(51)

Self-limiting charger for nickel-cadmium batteries, by E. B. Pearson. Sandia Corp., Albuquerque, N. Mex. Aug 55. Changed from Official Use Only Oct. 21, 1959. 7p. Order from LC. Mi. $1.80 Ph. $1.80 SCTM-170-55-55

Certification of five-dial wheatstone bridges, by G. R. Fahrbach. Sandia Corp., Albuquerque, N. Mex. Dec 59. 24p. Order from LC. Mi. $2.70 Ph. $4.80 SCTM-181-59-(16)

Transistor driven beam switching tube decade counter, by Richard H. Graham. University of California, Livermore. Lawrence Radiation Lab. Aug 59. Contract W-7405-eng-48. 15p. Order from LC. Mi. $2.40 Ph. $3.30 UCRL-5656

Design limitations of a breakdown diode coupled transistor flip flop, by Thomas Archie Nunamaker (Thesis). University of California, Lawfence Radiation Laboratory, Berkeley, California. Jan 60. Contract W-7405-eng-48. 55p. Order from OTS. $1.50 UCRL-9046

Nuclear materials control system (nmcs), phase II. alarm transmitting systems and the protection of communications, by J. N. Ellyson and G. Kivenson. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. 68p. Order from LC. Mi. $4.80 Ph. $13.80 WCAP-6022

Nuclear materials control system (nmcs). Phase II, miscellaneous devices for plant security, by G. Kivenson and J. N. Ellyson. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. 23p. Order from LC. Mi. $2.70 Ph. $4.80 WCAP-6023

Nuclear materials control system (nmcs). Phase II, miscellaneous devices for safeguarding a fuel reprocessing plant, by W. E. Foster. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. 22p. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6024

Nuclear materials control system (nmcs), Phase II, liquid samplers for safeguards use, by W. E. Foster. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176. 13p. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6025

Nuclear materials control system (nmcs), Phase II, neutron flux monitors for safeguards use, by R. E. Kronk. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176. 23p. Order from LC. Mi. $2.70 Ph. $4.80 WCAP-6027

Nuclear materials control system (nmcs), Phase II, a thermal power meter for safeguards use, by C. C. Webster. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct. 59. Contract AT(30-1)-2176, Task I. 15p. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6028

Nuclear materials control system, Phase II, general activity detectors for safeguards use, by F. J. Arsenault. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6029

Metallurgy and Ceramics

Corrosion investigations on high-temperature aluminum alloys, February 1955-October 1957, by C. R. Breden and N. R. Grant. Argonne National Laboratory, Lemont, Illinois. Feb 60. Contract W-31-109-eng-38. 72p. Order from OTS. $2.00. ANL-5546

The manufacture of the graphite-urania fuel matrix for treat, by J. H. Handwerk and R. C. Lied. Argonne National Laboratory, Lemont, Illinois. Jan 60. Contract W-31-109-eng-38. 26p. Order from OTS. $.75. ANL-5963

Plastic flow during extrusion of tubing, by Henry A. Saller and others. Battelle Memorial Institute, Columbus, Ohio. Jul 55. Contract W-7405-eng-92. 18p. Order from OTS. $.50. BMI-1021

Plastic deformation in grooved rolls, by Henry A. Saller. Battelle Memorial Institute, Columbus, Ohio. Sep 55. Contract W-7405-eng-92. 50p. Order from OTS. $1.00. BMI-1040

Progress relating to civilian applications during July, 1959, by Russell W. Dayton and Clyde R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Aug 59. Contract W-7405-eng-92. 104p. Order from OTS. $2.50. BMI-1366

Gas-pressure bonding of Zircaloy-clad flat-plate uranium dioxide fuel elements, by Stan J. Paprocki. Battelle Memorial Institute, Columbus, Ohio. Aug 59. Contract W-7405-eng-92. 106p. Order from OTS. $2.50. BMI-1374

Progress relating to civilian applications during October, 1959, by Russell W. Dayton and Clyde R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Nov 59. Contract W-7405-eng-92. 100p. Order from OTS. $2.50. BMI-1391(Rev.)

Progress relating to civilian applications during November, 1959, by Russell W. Dayton and Clyde R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Dec 59. Contract W-7405-eng-92. 110p. Order from OTS. $2.50. BMI-1398

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A method of correlating irradiation effects in dispersion fuels, by Donald L. Keller and others. Battelle Memorial Institute, Columbus, Ohio. Jan 60. Contract W-7405-eng-92. 16p. Order from OTS. $.75. BMI-1408

Progress relating to civilian applications during January, 1960, by Russell W. Dayton and Clyde R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 102p. Order from OTS. $2.50. BMI-1409

Development of high-strength niobium alloys for elevated-temperature applications, by John A. DeMastry. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 22p. Order from OTS. $.75. BMI-1417

Development of high-strength corrosion resistant zirconium alloys, by John A. De Mastry and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 18p. Order from OTS. $.75. BMI-1418

High-temperature irradiation of metals and graphite in flowing helium, by Neil E. Miller and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 16p. Order from OTS. $.75. BMI-1419

Effects of yttrium on the fabrication and tensile properties of two modified stainless alloys, by John A. DeMastry and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 16p. Order from OTS. $.75. BMI-1420

The diffusion of hydrogen in zirconium hydride, by William M. Albrecht and W. Douglas Goode, Jr. Battelle Memorial Institute, Columbus, Ohio. Mar 60. Contract W-7405-eng-92. 10p. Order from OTS. $.50. BMI-1426

Extrusion of uranium for hanford cored slug program-I, by R. M. Treco and others. Bridgeport Brass Company, Bridgeport, Conn. Dec 54. Contract AT(30-1)-1405. 65p. Order from OTS. $.50. BRB-3

Hardness evaluation of alpha hot-rolled uranium rod for drawing, by M. T. McGowan and others. Bridgeport Brass Company, Bridgeport, Conn. Aug 55. Decl. Feb 60. Contract AT(30-1)-1405. 28p. Order from OTS. $.50. BRB-7

Investigation of resistance to heat flow through clad plates, by Earl E. Coulter and D. L. Mayer. Babcock and Wilcox Co. Research and Development Dept., Alliance, Ohio. Apr 51. Subcontract 14-302. 21p. Order from LC. Mi. $2.40 Ph. $3.30. BW-5406

Examination of sodium, beryllium, inconel pump loops, numbers 1 and 2, by G. M. Adamson and and E. Long. Oak Ridge National Lab., Tenn. Sep 54. Decl. Oct 59. Contract W-7405-eng-26. 12p. Order from LC. Mi. $2.40 Ph. $3.30. CF-54-9-98

Results of static corrosion tests on various nickel-base brazing alloys used to fabricate 304 stainless steel joints tested in sodium and fluoride #44 ($NaF-ZrF_4-UF_4$) for 100 hours at 1500°F, by E. E. Hoffman. Oak Ridge National Lab., Tenn. Dec 54. Decl. Jun 59. Contract W-7405-eng-26. 3p. Order from LC. Mi. $1.80 Ph. $1.80 CF-54-12-26

Post-irradiation examination of appr fuel element irradiation program specimens, by A. E. Richt. Oak Ridge National Lab., Tenn. Mar 59. 29p. Order from LC. Mi. $2.70 Ph. $4.80 CF-59-3-33

Determination of the nil-ductility-transition temperature for A212B steel used in the N. S. Savannah pressure vessel, by W. C. Thurber and J. T. Lamartine. Oak Ridge National Lab., Tenn. Jul 59. Contract W-7405-eng-26. 26p. Order from LC. Mi. $2.70 Ph. $4.80 CF-59-7-143

Welded seal-ring vacuum closures, by C. Michelson. Oak Ridge National Lab., Tenn. Aug 59. Contract W-7405-eng-26. 36p. Order from LC.

Mi. $3.00 Ph. $6.30 CF-59-8-80

Further evaluation of check valve material for the homogeneous reactor program, by R. Blumberg. Oak Ridge National Lab., Tenn. Aug 59. 14p. Order from LC. Mi. $2.40 Ph. $3.30 CF-59-8-135

Study of oxide films and scales on zirconium alloys, by Otto Zmeskal and G. M. Adamson. Oak Ridge National Lab., Tenn. Sep 59. 30p. Order from LC. Mi. $2.70 Ph. $4.80 CF-59-9-1

Tabular summary of in-pile rocking autoclave solution corrosion data, by R. J. Davis. Oak Ridge National Lab., Tenn. Sep 59. 19p. Order from LC. Mi. $2.70 Ph. $4.80 CF-59-9-75

Development of swaged stainless steel fuel rods containing UO_2, by J. T. Lamartine and W. C. Thurber. Oak Ridge National Lab., Tenn. Oct 59. Contract W-7405-eng-26. 46p. Order from LC. Mi. $3.30 Ph. $7.80 CF-59-10-8

The effect of closed porosity on the accuracy of the model for fission-gas release from UO_2, by M. W. Rosenthal. Oak Ridge National Lab., Tenn. Nov 59. Contract W-7405-eng-26. 14p. Order from LC. Mi. $2.40 Ph. $3.30 CF-59-11-24

Corrosion resistance of CD_4MCu stainless steel in reactor-related environments, by D. N. Hess and others. Oak Ridge National Lab., Tenn. Nov 59. 12p. Order from LC. Mi. $2.40 Ph. $3.30 CF-59-11-114

Corrosion of carbon steel in waste solutions containing mercury, by P. M. Kranzlein. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Aiken, South Carolina. Nov 59. Contract AT(07-2)-1. 12p. Order from OTS. $.50. DP-416

Corrosion of stainless steel in thorex process solutions, by P. M. Kranzlein. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Aiken, South Carolina. Dec 59. Contract AT(07-2)-1. 15p. Order from OTS. $.50. DP-429

Standard operating procedure for rolling 2.75% enriched metal at simonds saw and steel company, by John F. Schiltz. National Lead Co. of Ohio, Cincinnati. Oct 54. Decl. Aug 59. Contract AT(30-1)-1156. 7p. Order from LC. Mi. $1.80 Ph. $1.80 FMPC-477

The fabrication of the fuel elements for the uo2 high burn-up program, by E. A. Lees and others. Vallecitos Atomic Lab., General Electric Co., Pleasanton, California. Jan 59. Contract AT(04-3)-237. 28p. Order from OTS. $1.00 GEAP-3108 Pt. 1

Borides of interest for control materials, by A. N. Holden. Vallecitos Atomic Lab., General Electric Co., Pleasanton, California. Jan 59. Contract AT(04-3)-189. 9p. Order from OTS. $.50 GEAP-3117

Outgassing tests of uranium slugs, by H. A. Johnson. Engineering Dept., Hanford Works, Richland, Washington. May 53. 5p. Order from OTS. $.25 HW-27885

The identification of the angular inclusions present in rolled uranium, by F. A. Scott. Hanford Works, Richland, Washington. May 53. 5p. Order from OTS. $.25 HW-28035

Development of ultrasonic unbond test, by C. L. Frederick. Hanford Atomic Products Operation, Richland, Washington. Jun 54. Contract W-31-109-eng-52. 15p. Order from OTS. $.30 HW-32186

Zirconium cladding of uranium, by P. J. Pankaskie and L. D. Schaffer. Hanford Atomic Products Operation, Richland, Washington. Nov 54. Contract W-31-109-Eng-52. 27p. Order from OTS. $.35 HW-33419

Preliminary investigation of the uniskan process for the extrusion of sizing of tubular sections, by A. T. Taylor. Hanford Atomic Products Operation Richland, Washington. Nov 54. Contract W-31-109-Eng-52. 38p. Order from OTS. $.40 HW-33849

Inhibition of HNO_3-HF corrosion of type 304-L stainless steel with $Al(NO_3)_3 \cdot 9H_2O$., by W. L. Walker. General Electric Co. Hanford Atomic Products Operation, Richland, Washington; Nov. 57. 3p. Order from LC. Mi. $1.80 Ph. $1.80 HW-53636

Bondtesting zircaloy clad coextruded fuel elements, by T. G. Lambert. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Apr 58. Decl Sep 59. 6p. Order from LC. Mi. $1.80 Ph. $1.80 HW-55912

An x-ray diffraction study of irradiated molybdenum, by D. L. Gray and W. V. Cummings, Jr. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Jul 59. Contract W-31-109-eng-52. 19p. Order from LC. Mi. $2.40 Ph. $3.30 HW-60907

A review of the properties of zircaloy-2, by G. E. Zima. Hanford Atomic Products Operation, Richland, Washington. Oct 59. Contract AT(45-1)-1350. 100p. Order from OTS. $2.50 HW-60908

Irradiation testing of plutonium-uranium oxide nuclear fuel, by J. L. Bates and W. E. Roake. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Jul 59. Contract AT(45-1)-1350. 25p. Order from OTS. $.75. HW-61142

An effect of neutron flux level upon damage accumulation, by D. L. Gray. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Jul 59. Contract AT(45-1)-1350. 10p. Order from OTS. $.50. HW-61287

High temperature aqueous corrosion of aluminum-plutonium and aluminum-silicon-plutonium alloys, by H. C. Bowen. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Jul 59. Contract AT(45-1)-1350. 8p. Order from LC. Mi. $1.80 Ph. $1.80 HW-61345

Precision duplication of metal parts in tooling plastics, by J. H. Kleinpeter. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Aug 59. Contract W-31-109-Eng-52. 6p. Order from LC. Mi. $1.80 Ph. $1.80 HW-61583

Zirconium tube rupture from localized overheating, by P. M. Jackson. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Sep 59. Contract AT(45-1)-1350. 9p. Order from LC. Mi. $1.80 Ph. $1.80 HW-61846

An estimation of the explosion hazard during reprocessing of metallic uranium fuel elements metallurgically bonded to zircaloy cladding, by J. L. Swanson. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Sep 59. Contract (45-1)-1350. 10 p. Order from LC. Mi. $1.80 Ph. $1.80 HW-62109

Zircaloy-2 pilot plant etching and rinsing facility, by H. P. Maffei. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Dec 59. Contract AT(45-1)-1350. 20p. Order OTS. $.75. HW-62942

Note on the determination of the magnetoresistance tensor of a crystal having the symmetry O_h or O, by Toshihiro Okada. Ames Laboratory, Iowa state University of Science and Technology. Jan 60. Contract W-7405-eng-82. 16p. Order from OTS. $.50 IS-67

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On the application of multigroup diffusion theory to fast critical assemblies, by David Okrent. Argonne National Laboratory, Lemont, Illinois. Sep 54. Contract W-31-109-eng-38. 35p. Order from OTS. $.35. ANL-5321(Rev.)

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Numerical solution of the one-group, space-independent reactor kinetics equations for neutron density given the excess reactivity, by J. J. Kaganove. Argonne National Laboratory, Lemont, Illinois. Feb 60. Contract W-31-109-eng-38. 14p. Order from OTS. $.50. ANL-6132

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A recirculating supercritical water loop, by H. M. Epstein and others. Battelle Memorial Inst., Columbus, Ohio. Oct 54. Decl Aug 59. Contract W-7405-eng-92. 20p. Order from LC. Mi. $2.40 Ph. $3.30. BMI-918

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Applications of distributions, by Prof. B. Friedman. Brookhaven National Lab., Upton, N. Y. Jun 59. 12p. Order from OTS. $.50. BNL-575(T-158)

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Thermal characteristics of the art fuel-to-NaK-heat exchanger, by J. L. Wantland. Oak Ridge National Lab., Tenn. Dec 55. Decl Sep 59. 32p. Order from LC. Mi. $3.00 Ph. $6.30. CF-55-12-120

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Determination of suitable insulation for A 1-5/16" helium filled annulus in the orr helium in-pile loop, design no. 4, by R. B. Knight and R. E. Helms. Oak Ridge National Lab., Tenn. Aug 59. Contract [W-7405-eng-26]. 61p. Order from LC Mi. $4.50 Ph. $12.30. CF-59-8-57

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Reaction cross sections using the statistical model of the compound nucleus, by S. K. Penny. Oak Ridge National Lab., Tenn. Sep 59. 13p. Order from LC. Mi. $2.40 Ph. $3.30. CF-59-9-11

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An ibm-704 code for determining equilibrium orbits and properties of small-amplitude oscillations in cyclotron fields, by M. M. Gordon and others. Oak Ridge National Lab., Tenn. Nov 59. 55p. Order from LC. Mi. $3.60 Ph. $9.30. CF-59-11-2

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Unclassified cross sections for fast reactor calculations, by F. E. Bjorklund. California Research and Development Co., Livermore, Calif. Jan 53. 18p. Order from LC. Mi. $2.40 Ph. $3.30. CRD-R-31

Paramagnetic resonance absorption in neptunium hexafluoride, by Clyde A. Hutchison, Jr., and Bernard Weinstock. Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies and Argonne National Lab., Lemont, Ill. 1959. 25p. Order from LC. Mi. $2.70 Ph. $4.80. EFINS-59-35

Mathematical formulation of the one-dimensionalized dynamics of a diffusing binary gas, by V. Fillipenko. California. Univ., Berkeley. Inst. of Engineering Research. Dec 57. Contract AT(11-1)-34. 22p. Order from LC. Mi. $2.70 Ph. $4.80. HE-150-151

Lamb waves at ultrasonic frequencies, by D. C. Worlton. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Jun 59. Contract W-31-109-Eng-52. 58p. Order from LC. Mi. $3.60 Ph. $9.30. HW-60662

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A survey and preliminary analysis of the problem of collapse of fuel plates, by J. D. Lubahn and W. D. Fowler. Knolls Atomic Power Lab., Schenectady, N. Y. Aug 59. Contract W-31-109-Eng-52. 58p. Order from LC. Mi. $3.90 Ph. $10.80. KAPL-M-JDL-2

The effect of sequential batching for acceptance-rejection sampling upon sample assurance of total product quality, by M. Halperin and G. L. Burrows. General Electric Co. Knolls Atomic Power Laboratory., Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 11p. Order from OTS. $.75. KAPL-2033

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Reactor spectra effects on fission fragment cross sections, by C. R. Greenhow and E. C. Hansen. General Electric Co. Knolls Atomic Laboratory., Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 21p. Order from OTS. $1.00. KAPL-2057

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Closed loop code for ibm-704, by R. D. Howerton. Knolls Atomic Power Lab., Schenectady, N. Y. Jul 59. Contract W-31-109-Eng-52. 24p. Order from LC. Mi. $2.70 Ph. $4.80. KAPL-M-RDH-1

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Angular distribution of fragments from neutron-induced fission, by J. E. Brolley, Jr., and W. C. Dickinson. University of California. Los Alamos Scientific Lab., Los Alamos, N. Mex. May 53. Contract W-7405-Eng-36. 22p. Order from OTS. $.35. LA-1552

A one dimensional intermediate reactor computing program, by Forrest Brinkley. University of California, Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 88p. Order from OTS. $2.25. LA-2161

Duration of atomic collisions. A note on recombination rate theory, by Don L. Bunker. Los Alamos Scientific Lab., N. Mex. Nov 58. Contract W-7405-eng-36. Order from LC. Mi. $2.70 Ph. $4.80. LA-2295

X-ray crystallographic intensity functions, by Charles P. Kempter and others. Los Alamos Scientific Lab., N. Mex. Feb 59. Contract W-7405-eng-36. 110p. Order from LC. Mi. $6.00 Ph. $18.30. LA-2299

The solution of the general least squares problem with special reference to high-speed computers by R. H. Moore and R. K. Zeigler. University of Calif. Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 94p. Order from OTS. $2.25. LA-2367

Molybdenum cross sections and their temperature dependence, by Joseph J. Devaney and others. University of Calif. Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 128p. Order from OTS. $2.75. LA-2373

Calculated properties of mu-mesonic atoms, by Kenneth W. Ford and John G. Wills. University of California. Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 46p. Order from OTS. $1.25. LAMS-2387

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Survey of the literature pertaining to the phenomena of nucleate boiling, by R. A. Rockow. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Aug 59. 27p. Order from LC. Mi. $2.70 Ph. $4.80. NAA-SR-MEMO-4160

Least squares analyses of axial neutron flux distribution in exponential assemblies, by G. W. Rodeback. Jul 59. 7p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-4189

Maritime OMCR burnup study, by R. W. Hardy and R. Tanaka. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sep 59. 4p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-4380

Calculations with multigroup adjoints, by F. H. Clark. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sep 59. 10p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-4327

Tables of O^n for reactor slabs, cylinders, and spheres, n= 1 to n = 20, by Raymond L. Murray. North Carolina State College, Dept., of

Engineering, Raleigh, N. Carolina. Nov 58. 56p. Order from OTS. $1.50. NCSC-B-70

Conservation laws in weak interactions, by T. D. Lee. Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs. Mar 57. Contract N6-ori-110, Task no. 1 and AT(30-1)-1932. 61p. Order from LC. Mi. $3.90 Ph. $10.80. NEVIS-50

The interactions of 173 mev negative pions in deuterium (thesis), by Robert L. Bingham. Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs. Dec 58. Contracts N6-ori-110 and AT(30-1)-1932. 44p. Order from LC. Mi. $3.30 Ph. $7.80. NEVIS-73

Thermal conductance of metallic surfaces in contact, by Henri Fenech and W. M. Rohsenow. Heat Transfer Lab., Mass. Inst., of Tech. Cambridge, Mass. May 59. Contract AT(30-1)-2079. 166p. Order from OTS. $3.00. NYO-2136

μ-meson capture in Li^6 leading to the ground state of He^6, by H Uberall. Carnegie Inst. of Tech., Pittsburgh. Apr 59. Contract AT(30-1)-882. 30p. Order from LC. Mi. $3.00 Ph. $6.30. NYO-2236

Economic production of pulsed D. C. power. A Proposal of (1) Methods of High Utilization of Flywheel Energy (2) High Output Pulsed D. C. generators. Technical Memorandum No. 14, by Robert G. Mills. Princeton Univ., N. J. Project Matterhorn. Jan 55. 18p. Order from LC. Mi. $2.40 Ph. $3.30. NYO-2411

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Combinatorial properties of machine shop scheduling, by Jack Heller. New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center. Jul 59. 43p. Order from LC. Mi. $3.30 Ph. $7.80. NYO-2879

The theoretical calculation of the heat of adsorption for gases physically adsorbed on carbon surfaces, by E. L. Pace. Western Researve Univ., Cleveland. Sep 59. Contract AT(30-1)-824. 27p. Order from LC. Mi. $2.70 Ph. $4.80. NYO-4884

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Aircraft reactor test hazards summary report, by W. B. Cottell and others. Oak Ridge National Lab., Tenn. Jan 55. Decl Oct 59. Contract W-7405-eng-26. 156p. Order from LC. Mi $7.50 Ph. $24.30. ORNL-1835

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Stopping power of thin aluminum foils for 12 to 127 kev electrons, by Ford Kalil and others. Oak Ridge National Lab., Tenn. Sep 59. Contract W-7405-eng-26. 134p. Order from LC. Mi. $6.30 Ph. $19.80. ORNL-2731

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The scattering and polarization of spin one particle, by G. R. Satchler. Oak Ridge National Lab., Tenn. [nd]. Contract W-7405-eng-26. 41p. Order from OTS. $1.25. ORNL-2861

On the disk to point or infinite plane shielding transformations, by E. P. Blizard. Oak Ridge National Lab., Tenn. [nd]. Contract W-7405-eng-26. 12p. Order from OTS. $.50. ORNL-2882

Sample scattering corrections in neutron beam experiments, by H. W. Schmitt. Oak Ridge National Lab., Tenn. [nd]. Contract W-7405-Eng-26. 20p. Order from OTS. $.75. ORNL-2883

Measurement of electron attachment in oxygen-methane and oxygen carbon-dioxide mixtures, by L. B. O'Kelly and others. Oak Ridge National Lab., Tenn. [nd]. Contract W-7405-eng-26. 72p. Order from OTS. $2.25. ORNL-2887

Studies of the spherical harmonics method in neutron transport theory. IV. completion of the analysis of the limit-process L oo for the milne problem with anisotropic scattering and absorption. Planning of the numerical calculations, by Walter Kofink. Oak Ridge National Lab., Tenn. [nd]. Contract W-7405-eng-26. 46p. Order from OTS. $1.50. ORNL-2901

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Relativistic self-consistent calculation for the normal tungsten atom, by Stanley Cohen. Rand Corp., Santa Monica, Calif. Jun 59. Contract AT(11-1)-135. 58p. Order from LC. Mi $3.60 Ph. $9.30. RM-2404-AEC

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Tabulation of the hypergeometric probability distribution for lot sizes less than or equal to 50, by D. B. Owen. Sandia Corp., Albuquerque, N. Mex. Aug 59. 31p. Order from LC. Mi. $3.00 Ph. $6.30. SCTM-215-59(51)

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Calibration of OMR test element anemometers, by M. Starr. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jul 59. 11p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-4201

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Summary of extended boiling test no. 5 with irradiated OMRE coolant, by D. A. Huber and J. Kortenhoeven. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jul 59. 7p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-4075

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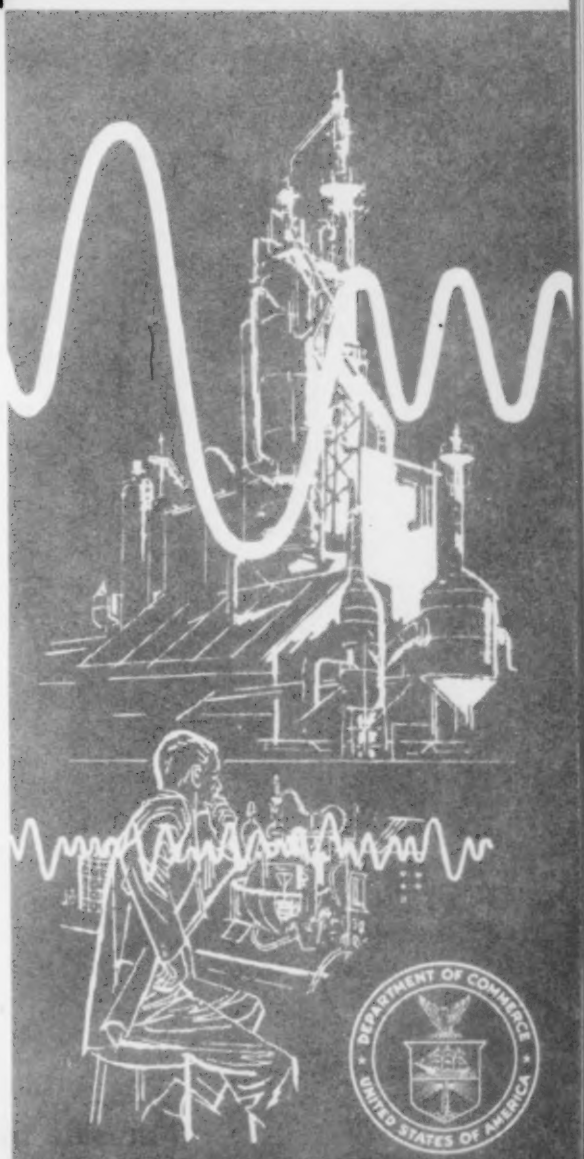

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	408	144 401
	534	145 341
	661	145 515
		145 581
Wayne State U. Coll. of Engineering, Detroit, Mich.	570	145 172
Weather Bureau, Washington, D. C.	138	144 114
	368	144 689
Weizmann Inst. of Science (Israel)	657	145 118
	676	145 689
West Virginia U., Morgantown	476	144 913
Western Biological Labs., Culver City, Calif.	604	161 501
Western Ontario U. (Canada)	318	144 003
		144 005
	319	144 004
Westinghouse Electric Corp., Baltimore, Md.	640	145 569
	647	145 477
Westinghouse Electric Corp., Boston, Mass.	511	144 975
Westinghouse Electric Corp., East Pittsburgh, Pa.	88	161 078
	203	161 149
	211	143 629
Westinghouse Electric Corp., Youngwood, Pa.	690	145 370
Westinghouse Research Labs., Pittsburgh, Pa.	65	143 644
	323	144 188
	374	142 947
	511	161 366
Wetterdienst, Offenbach (West Germany)	612	137 523
Wharton School of Finance and Commerce, U. of Pennsylvania Philadelphia	35	143 704
		143 795
		143 798
		143 799
		143 800
	140	143 796
Whirlpool Corp., St. Joseph, Mich.	280	144 183
Wichita U., Kansas	619	145 123
Wichita U. School of Engineering, Kans.	191	138 959
	785	145 042
Willow Run Labs., U. of Michigan, Ann Arbor	142	143 447
	164	143 626
	211	143 181
	218	143 545
	358	144 548
	425	161 329
		161 330
	426	144 502
	460	144 697
	465	144 733
	476	145 119
	511	145 120
	536	145 108
	566	144 569
		144 734
		145 121
	662	137 524
	669	145 375
Wilson and Co., Inc., Chicago, Ill.	649	145 763
Wisconsin U., Madison	129	143 641
	131	143 589
	131	143 599
	139	143 614
	140	143 100
Wisconsin U., Madison (con.)	330	143 859
	361	161 315
	368	144 428
	408	144 433
	476	144 859
		144 865
	476	145 083
	544	144 796
	675	145 511
Wisconsin U. School of Medicine, Madison	467	145 092
Woods Hole Oceanographic Institution, Mass.	253	144 191
	482	138 326
	561	137 955
X-Ray and Crystal Analysis Lab., Pennsylvania State U., University Park	560	145 204
Yale U., New Haven, Conn.	119	143 847
	120	143 862
	141	143 863
	187	143 848
	238	143 856
		144 273
	296	143 981
	323	143 955
	422	138 079
		138 253
	492	161 383
	554	137 686
	676	138 352
Yale U. School of Medicine, New Haven	124	161 131
Zator Co., Cambridge, Mass.	218	161 263

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